# PHYSICS ABSTRACTS

SECTION A

*of*

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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ABSTRACTS 2081-2401

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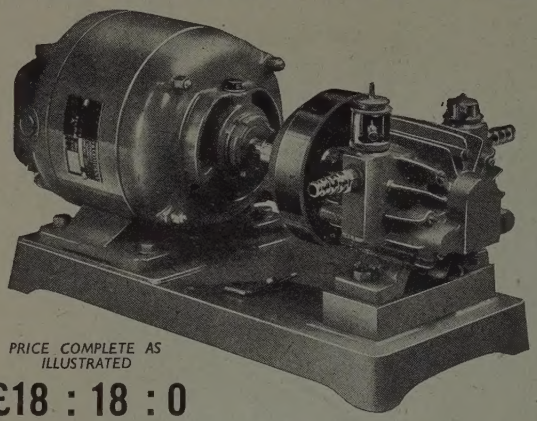

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## CONTENTS

### ABSTRACTS 2081–2401


| | | Page |
|---|---|---|
| 061 | Annual reports | 233 |
| 51 | Mathematics | 233 |
| 511 | Arithmetic | 233 |
| 512 | Algebra | 233 |
| 513 | Geometry | 233 |
| 517 | Analysis | 233 |
| .5 | Functions | 234 |
| .9 | Diff. equations | 234 |
| 518 | Calculation | 234 |
| 519.2 | Probability | 235 |
| .4 | Groups | 235 |
| 52 | Astronomy | 236 |
| 523 | Descriptive | 236 |
| .1 | Cosmology | 236 |
| .4 | Planets | 236 |
| .7 | Sun | 236 |
| .8 | Stars | 236 |
| 526 | Geodesy | 238 |
| 53 | Physics | 238 |
| .081 | Units. Dimensions | 238 |
| 530.12 | Relativity | 238 |
| .145 | Quantum theory | 239 |
| 531 | Mechanics of solids | 239 |
| .7 | Measurements | 240 |
| 532 | Mechanics of fluids | 241 |
| .13 | Viscosity | 241 |
| .5 | Hydrodynamics | 242 |
| .61 | Surface tension | 242 |
| .63/.68 | Capillarity | 243 |
| .69 | Surface activity | 243 |
| .71 | Osmosis | 243 |
| .72 | Diffusion | 243 |
| .73/.78 | Solution | 243 |
| 533 | Mechanics of gases | 244 |
| .6 | Aerodynamics | 244 |
| 534 | Acoustics | 244 |
| 535 | Optics | 245 |
| .1 | Theory | 245 |
| .2 | Radiation | 246 |
| .215 | Photo-electricity | 246 |
| .24 | Photometry | 246 |
| .31 | Geom. optics | 247 |
| 535.32 | Refr. index | 247 |
| .33 | Spectroscopy | 247 |
| .338 | Spectra | 248 |
| .34 | Absorption | 248 |
| .37 | Fluorescence | 249 |
| .375 | Raman effect | 249 |
| .41 | Interference | 249 |
| .43 | Scattering | 249 |
| .6 | Colour | 249 |
| .7 | Vision | 250 |
| .8 | Instruments | 250 |
| 536 | Heat | 250 |
| .7 | Thermodynamics | 251 |
| .8 | Heat engines | 252 |
| 537 | Electricity | 252 |
| .12 | Electrons | 252 |
| .2 | Electrostatics | 252 |
| .226 | Dielectrics | 253 |
| .29 | Electric fields | 253 |
| .31 | Conductivity | 253 |
| .5 | Discharge | 254 |
| .531 | X-rays | 255 |
| .533 | Neg. rays | 255 |
| .534 | Pos. rays | 256 |
| .56 | Ionization | 257 |
| .59 | Cosmic rays | 257 |
| 538 | Magnetism | 259 |
| .1 | Theory | 259 |
| .2 | Properties | 260 |
| .54 | Eddy currents | 260 |
| .56 | Electromagn. oscill. | 260 |
| .6 | Magnetic fields | 260 |
| .7 | Terrestr. magnetism | 260 |
| 539.13 | Molecules | 260 |
| .15 | Atoms | 261 |
| .16 | Radioactivity | 261 |
| .17 | Atom disintegration | 262 |
| .185 | Neutrons | 262 |
| .2 | Structure of solids | 262 |
| .26 | X-ray exam. | 264 |
| .3 | Elasticity | 264 |

61.055.1 : 550.3 *see Abstr.* 2600
61.055.5 : 550 *see Abstr.* 2599
61.055.5 : 550.381 *see Abstr.* 2604
61.22 : 535.42 : 537.533.73 : 537.531 *see Abstr.* 2311
11.23 2081

**On the integral order, (mod $p$) of quadratics $x^2 + ax + b$, with applications to the construction of minimum functions for $GF(p^2)$, and to some number theory results.** BOSE, R. C., CHOWLA, S., AND RAO, T. R. *Bull. Calcutta Math. Soc.*, 36, *pp.* 153–174, *Dec.*, 1944.—Polynomials are considered whose coefficients belong to the ring of integers, and $p$ is an odd prime. The least positive integer $n$ such that $x^n \equiv$ an integer (mod $p$, $x^2 + ax + b$), is called the integral order of $x^2 + ax + b$, (mod $p$). A number of theorems are deduced concerning the integral order. Given $b \neq 0$, all quadratics $x^2 + ax + b$ of a given type and integral order are found, and these are used in constructing minimum functions for $GF(p^2)$. Some known results concerning these functions are extended. Given $a \neq 0$, all quadratics $x^2 + ax + b$ of a given type and integral order are found, and necessary and sufficient conditions are investigated under which the congruence $f_n(a, b) \equiv 0$ (mod $p$) is solvable, (i) when regarded as a congruence in $a$, (ii) when regarded as a congruence in $b$. Here $f_n(a, b) = F_n(y - \frac{1}{2}a, -y - \frac{1}{2}a)$ where $y^2 = \frac{1}{4}(a^2 - 4b)$ and $F_n(X, Z)$ is the result of making $F_n(X)$, the cyclotomic polynomial of order $n$, homogeneous by introducing $Z$. The applications to number theory include the determination of primes $p$, such that 2, 3 or 5 are quadratic residues of $p$, and the solvability of the cubic congruences

$x^3 - 3x \equiv +1$ (mod $p$), $x^3 - 3x \equiv -1$ (mod $p$)

L. S. G.
511.5 2082

**Euler's three biquadrate problem.** WARD, M. *Proc. Nat. Acad. Sci., Wash.*, 31, *pp.* 125–127, *April*, 1945.—The problem is whether the diophantine equation $x^4 + y^4 + z^4 = \omega^4$ has any integral solutions. It is shown that there cannot be a solution with $\omega < 10\,000$. L. S. G.
511.9 2083

**A peculiar gap-filling process for powers of $(9)_n$.** KAPREKAR, D. R. *J. Univ. Bombay*, 13, *p.* 1, *March*, 1945.—By $(9)_n$ we mean the digit 9 repeated $n$ times, and by $(9)_n^m$ we mean the $m$th power of $(9)_n$. A quick method is given for writing down $(9)_n^m$. L. S. G.
512.1 : 621.3.014 2084

**Electronic circuits perform mathematical processes.** BEITMAN, M. N. *Radio News*, 33, *pp.* 72 *and* 74, *May*, 1945.—[Abstr. 1875 B (1945)].
512.52 2085

**Method of Lagrangian curvilinear interpolation.** TAYLOR, W. J. *J. Res. Nat. Bur. Stand., Wash.*, 35, *pp.* 151–155, *Aug.*, 1945.—Describes a simplified method of computing Lagrangian coefficients for curvilinear interpolation, which may be used when tables of Lagrangian coefficients are not available or when tables are available but the coefficients are not tabulated for the exact fraction of the interval to which the interpolation is to be made.

513.3 : 548.1 *see Abstr.* 2567
513.563 : 513.734 *see Abstr.* 2088
513.564.1 2086

**On a problem in solid geometry.** RAO, C. V. H. *Bull. Calcutta Math. Soc.*, 36, *pp.* 132–134, *Dec.*, 1944.—The lengths of the axes of an arbitrary plane section of the general quadric surface are determined. L. S. G.
513.622.11 2087

**On surface area.** RADO, T. *Proc. Nat. Acad. Sci., Wash.*, 31, *pp.* 102–106, *March*, 1945.—The surface area of Frechet surfaces, $S$, of the type of the 2-cell is considered. A quantity $a(S)$, termed the lower area of $S$, is introduced, using conceptions in the theory of continuous transformations in the plane. The relationship of $a(S)$ to the Lesbesgue area of $S$, denoted by $A(S)$ is studied, and conditions are given in order that $a(S) = A(S)$. L. S. G.
513.734 : 513.563 2088

**On scrolls generated by lines whose polars with regard to a pencil and a net of quadrics are concurrent.** CHARIAR, V. R. *Bull. Calcutta Math. Soc.*, 36, *pp.* 122–124, *Dec.*, 1944.—A study is made of surfaces generated by lines, $l$, whose polars with respect to a given pencil, $\Omega$, of quadrics intersect. The lines, $l$, through a given point generate a quadric cone passing through the vertices of the self conjugate tetrahedron. Also lines which intersect a given line, $\lambda$, and whose polars with respect to 2 pencils of quadrics are concurrent, pencil by pencil, generate a surface, $\Sigma$, of order 8 having $\lambda$ as a multiple curve of order 4. A plane $\pi$ through $\lambda$ meets $\Sigma$ residually in 4 straight lines which intersect in pairs in 6 points. As $\pi$ varies these 6 points trace out a curve of order 6 which is double on $\Sigma$. Various other properties of $\Sigma$ are deduced, and it is shown that the polars of a given line with respect to 3 given quadrics will be concurrent only when the line is the generator of a certain ruled surface of order 9. L. S. G.
513.76 2089

**Irregular projective invariants.** KASNER, E., AND DE CICCO, J. *Proc. Nat. Acad. Sci., Wash.*, 31, *pp.* 123–125, *April*, 1945.—A brief summary of the classification of irregular analytic elements with respect to the 8-parameter group of collineations in the plane. An irregular element with a simple cusp possesses 2 relative invariants of the 7th and 8th orders. L. S. G.
513.761.4 : 513.83 2090

**Axiomatic approach to homology theory.** EILENBERG, S., AND STEENROD, N. E. *Proc. Nat. Acad. Sci., Wash.*, 31, *pp.* 117–120, *April*, 1945.—The usual approach to the concept, homology group, involving the study of the complex, is here replaced by an axiomatic approach, which results in greater logical simplicity and a broadened point of view. Only a brief outline is given. L. S. G.
513.83 : 513.761.4 *see Abstr.* 2090
517.392 : 518.12 2091

**Table of coefficients for numerical integration without differences.** LOWAN, A. N., AND SALZER, H. E. *J. Math. Phys.*, 24, *pp.* 1–21, *Feb.*, 1945.—

By integrating the Lagrangian interpolation formula the integral of a function $f(x)$, known for $n$ equally spaced arguments at interval $h$, is given as

$$\int_{x_0+rh}^{x_0+sh} f(x)dx \sim h\sum_i \{B_i^{(n)}(s) - B_i^{(n)}(r)\} f(x_0 + ih)$$

where the summation extends from $i = -[\frac{1}{2}(n-1)]$ to $i = [\frac{1}{2}n]$, and $B_i^n(p)$ are polynomials of degree $n$. Tables are given of the values of these polynomials to 10 decimal places, for $p$ ranging from $-\frac{1}{2}[(n-1]$ to $[\frac{1}{2}n]$. For $n = 3$, 4 and 5 the tabulation interval is 0·01 and for $n = 6$ and 7 the interval is 0·1. L. S. G.

517.512.2 : 548.1 *see Abstr.* 2568

517.512.4 : 621.396.619.018.41 2092

**Tables of Bessel functions $J_n(x)$ for large arguments.** CORRINGTON, M. S., AND MIEHLE, W. *J. Math. Phys.*, 24, *pp.* 30–50, *Feb.*, 1945.—Two tables of $J_n(ms)$ are given, to five decimal places, for $n = 0(1)10$ and $s = 1(1)20$. In the first the range of $m$ is 1(1)10 and in the second $m = \pi, 2\pi, \ldots, 5\pi$. The tables are convenient for use in the summation of the Schlömilch series which occur in the theory of frequency modulation, e.g. the calculation of the harmonic distortion terms and of the combination frequency amplitudes produced when an interfering signal is present in frequency-modulation transmission. L. S. G.

517.56 : 621.396.11 2093

**The parabolic cylinder functions.** WELLS, C. P., AND SPENCE, R. D. *J. Math. Phys.*, 24, *pp.* 51–64, *Feb.*, 1945.—The functions ${}_0U_a(\zeta)$ and ${}_eU_a(\zeta)$ which are solutions of

$$d^2U_a(\zeta)/d\zeta^2 + (\zeta^2 + a)U_a(\zeta) = 0,$$

are represented in a form suitable for the solution of problems involving standing waves. Power series solutions are given and the relation of $U_a(\zeta)$ to the confluent hypergeometric function is examined. Integral solutions,

$${}_eU_a(\zeta) = c_1\int_0^\infty (\operatorname{sech}\phi)^{\frac{1}{2}} \cos\{\tfrac{1}{2}\zeta^2 \tanh\phi + \tfrac{1}{2}a\phi\}d\phi$$

$${}_0U_a(\zeta) = c_2\int_0^\infty (\operatorname{sech}\phi)^{\frac{1}{2}} \cos\{\tfrac{1}{2}\zeta^2 \tanh\phi + \tfrac{1}{2}a\phi\}d\phi$$

are obtained and also solutions asymptotic in $a$ and these are useful when $\zeta$ is not too much larger than $a$. Solutions asymptotic in $\zeta$, suitable for computing the functions when $\zeta$ is large, are given and the functions are tabulated for $a = \pm 1, \pm 2, \pm 3$ over the range $\zeta = 0·00(0·1)3·00$. The functions occur in the problems of the propagation of electromagnetic waves in parabolic pipes and the vibrations of a parabolic membrane [Abstr. 170 B (1943)]. L. S. G.

517.564.3/.4 2094

**On certain integrals involving Legendre and Bessel functions.** BOSE, B. N. *Bull. Calcutta Math. Soc.*, 36, *pp.* 125–132, *Dec.*, 1944.—Some relations between Legendre and Bessel functions are obtained and used to establish certain definite integrals, e.g. integrals of the type

$$\int_0^1 P_n(1-2y^2)F(y)dy$$

where $F(y) = J_m(yz)y^{m+1}$ or $J_m^2(yz)y^{2m+1}$ $I_m(ky)K_m(ky)y^{2m+1}$ are evaluated as a finite ser whose terms involve Bessel and Gamma functio It is shown that, for a certain range of values of $h$,

$$\int_0^1 \frac{\sin(2y\,.\,z)dy}{\{(1-h)^2 + 4hy^2\}^{\frac{1}{2}}} = \tfrac{1}{2}\pi\sum_{n=0}^{\infty} h^n J_{n+\frac{1}{2}}^2(z)$$

The integral, $\int_0^\infty \frac{J_{2n+1}(yz)}{z(z^2+k^2)}dz$, and similar integrals a evaluated in closed form, and also

$$\int_0^\infty \frac{J_{2n+1}\{y(t^2+z^2)^{\frac{1}{2}}\}}{(t^2+z^2)^{\frac{1}{2}}}dt, \quad \int_0^\infty \frac{J_{2n+2}\{y(t^2+z^2)^{\frac{1}{2}}\}t}{t^2+z^2}d$$

and

$$\int_0^\infty \frac{J_{2n+1}\{y(t^2+z^2)^{\frac{1}{2}}\}J_{\mu+1}(bt)t^\mu}{(t^2+z^2)^{\frac{1}{2}}}dt$$

where $-1 < \mu < 2$ and $0 < y < b$. It is fina shown that

$$\int_{-\infty}^{\infty} \frac{\sin a(z+t)}{z+t}\frac{J_{2n+1}(yt)}{t}dt = \pi z^{-1}J_{2n+1}(yz)$$

provided $0 < y \leqslant a$. L. S.

517.912.2 : 621.3.012.8 20

**Numerical solution of ordinary and partial differenti equations by means of equivalent circuits.** KRON, *J. Appl. Phys.*, 16, *pp.* 172–186, *March*, 1945.- Numerical methods are developed to solve certa types of linear and nonlinear partial differenti equations to any desired degree of accuracy with t aid of equivalent electrical networks. The metho of solution of ordinary differential equations follo as special cases. Three types of problems are co sidered: (1) If the field quantities are known along surface, the networks may be solved by a straigh forward step-by-step calculation. For time-varyin problems new types of networks are developed in whic time appears as an extra spatial variable. (2) Fou methods of solution of boundary value problems ar given: (*a*) the method of weighted averages; (*b*) ur balanced currents and voltages; (*c*) relaxation metho (*d*) diffusion method, that changes the boundary value problem into an initial-value problem b adding to the original partial differential equation time variable. (3) Characteristic-value problems The methods of solution are similar to those o boundary-value problems.

517.945.6 = 4 209

**On a solution of the telegraphic equations.** PARODI H. *C.R. Acad. Sci., Paris*, 216, *pp.* 606–608, *May* 3 1943.—The equations are

$$\partial E/\partial x + rI + l\partial I/\partial t = 0, \quad \partial I/\partial x + gE + c\partial E/\partial t = 0$$

where $E$ and $I$ are the potential and current anc $r$, $l$, $g$ and $c$ are the (constant) line parameters. The solution is usually derived by eliminating one of the variables but in the new method given we write $E = \sum_i E_i$, $I = \sum_j I_j$ and split up each equation. Thus the first equation becomes

$$0 = \frac{\partial E_1}{\partial x} + \frac{\partial E_2}{\partial x} + \ldots + \frac{\partial E_n}{\partial x} + \ldots + rI_1 + \ldots + rI_{n-1} + \ldots + l\frac{\partial I_1}{\partial t} + \ldots + l\frac{\partial I_{n-1}}{\partial t} + \ldots$$

ow assume that the sum of the terms in each vertical ne is zero. After some reduction, the solution is btained in the form

$$E = E_1 \cosh x\Theta - I_1 S \sinh x\Theta$$

$$I = I_1 \cosh x\Theta - E_1 S \sinh x\Theta$$

here $\Theta = \{(lp+r)(cp+g)\}^{\frac{1}{2}}$, $S = (lp+r)^{\frac{1}{2}}(cp+g)^{-\frac{1}{2}}$ nd $p = \partial/\partial t$. In particular when $E_1 = E_0 e^{\omega t}$, $= KE_0 e^{\omega t}$ the usual solution is obtained. L. S. G.

17.947.5 = 4 2097

**A new solution of the equation $\Delta_3 U = U$.** HUMBERT, P. *C.R. Acad. Sci., Paris*, 216, *pp.* 657–659, *May* 17, 1943.—The equation,

$$\Delta_3 U = \frac{\partial^3 U}{\partial x^3} + \frac{\partial^3 U}{\partial y^3} + \frac{\partial^3 U}{\partial z^3} - 3\frac{\partial^3 U}{\partial x \partial y \partial z} = U$$

ay, by changing the variables to $X$, $Y$ and $Z$ where $= X^2 + 2YZ$, $y = Z^2 + 2XY$ and $z = Y^2 + 2XZ$ e written in the form

$$\frac{\partial^3 U}{X^3} + \frac{\partial^3 U}{\partial Y^3} + \frac{\partial^3 U}{\partial Z^3} - 3\frac{\partial^3 U}{\partial X \partial Y \partial Z} = 8(X^3 + Y^3 + Z^3 - 3XYZ)U$$

Here the variables may be separated by writing

$$U = F(r)G(s)\exp(X^2 + 2YZ)$$

where $r = 2X - Y - Z$ and $s = (Y - Z)\sqrt{3}$. It is found that the equations giving $F$ and $G$ are each satisfied by the confluent hypergeometric function, thus $F = {}_1F_1(h, \frac{1}{2}, -\frac{1}{3}r^2)$; $G = {}_1F_1(-h, \frac{1}{2}, \frac{1}{3}s^2)$, so the original equation is solved. L. S. G.

518.12 : 517:392 *see Abstr.* 2091

518.3 : 533.4 *see Abstr.* 2194

518.3 : 534.37 *see Abstr.* 2208

518.3 : 541.123.7 *see Abstr.* 2447

518.3 : 621.392.5 = 4 2098

**Quadripole nomograms. Their application to transmission lines.** DE MILLEVILLE, H. *Rev. Gén. Élect.*, 54, *pp.* 22–24, *Jan.*, 1945.

518.5 2099

**A problem-solving scale.** LEIVESLEY, V. W. *J. Instn Engrs, Aust.*, 17, *p.* 65, *March*, 1945.—Mark on a straight edge a linear scale of $x^2$ and number it in terms of $x$, thus producing a square law scale. This may be used directly for the usual Pythagorean operation $a = (b^2 \pm c^2)^{\frac{1}{2}}$, e.g. by using the scale to set off appropriate points along a straight line. Application to power factor economics, etc., is noted. G. F. F.

518.5 : 548.73 *see Abstr.* 2587

519.21 : 677.3 2100

**The statistical theory of the strength of bundles of threads. I.** DANIELS, H. E. *Proc. Roy. Soc. A*, 183, *pp.* 405–435, *June* 18, 1945.—The strength of a bundle is the maximum load which it can support. A study is made of the probability distribution of the strength of bundles whose constituent threads are sampled randomly from an infinite population of threads in which the probability distribution of strength is known. An expression is derived for the chance, $B_n$, that a bundle of $n$ threads is of strength less than a given value. $B_n$ is expressed firstly in the form of a determinant and then, in 2 ways, as a power series. The last half of the paper is devoted to an analytical investigation of the asymptotic behaviour of $B_n$ as $n \to \infty$. All the threads are assumed to have the same load-extension curve up to the breaking point. It is found that in the commonest cases, as $n \to \infty$, the distribution tends to the normal form. L. S. G.

519.24 : 621.315.62 2101

**Statistical methods applied to insulator development and manufacture.** TAYLOR, J. J. *Trans. Amer. Inst. Elect. Engrs*, 64, *pp.* 495–499, *July*, 1945.

519.271.1 2102

**The distribution of the mean of samples from a rectangular population.** IYER, P. V. K. *Curr. Sci.*, 14, *pp.* 18–19, *Jan.*, 1945.

519.271.1 2103

**A note on Hotelling's $T^2$.** IYER, P. V. K. *Curr. Sci.*, 14, *pp.* 173–175, *July*, 1945.—[Abstr. 2102 (1945)].

519.271.1 2104

**Minimum size of a sample.** SALVEKAR, P. M. *J. Univ. Bombay*, 13, *pp.* 2–6, *March*, 1945.—A table is given showing the minimum size required in experimental work in order to estimate the population mean with a specified degree of accuracy for a specified level of reliability. The method used in constructing the table is discussed. L. S. G.

519.272 2105

**Interaction formulae in analysis of variance.** AYYANGAR, A. A. K. *Curr. Sci.*, 14, *p.* 35, *Feb.*, 1945.

519.272 2106

**Familial correlations or the multivariate generalizations of the intraclass correlation.** RAO, C. R. K. *Curr. Sci.*, 14, *pp.* 66–67, *March*, 1945.

519.272.11 2107

**Regression lines and the functional relation.** SEARES, F. H. *Astrophys. J.*, 100, *pp.* 255–263, *Nov.*, 1944.—It is frequently required to find the functional relation $Y_1 = A + BX_1$ from values $X$, $Y$ of the variables which are affected by observational errors. A method is given for deriving $A$ and $B$ free from systematic error. Reduction of the values $X$ to the system of $Y$ is by the regression line of $Y$ on $X$ only in the case of observations of equal weight. Where the observations differ in precision no single line suffices, but an expression depending on $B$ and the mean error of $X$ is derived for the slope of the most probable line. This relation gives all the characteristic properties of the regression lines, among them the fact that the lines are strictly linear only when the frequency distribution for $X$ and $Y$ is Gaussian. A. HU.

519.283 : [62 + 66] 2108

**Statistical methods in deciding the efficacy of a modification in technical procedure: the use of the *t*-test to chemists and engineers.** EVANS, U. R. *Chem. and Ind.*, 14, *pp.* 106–109, *April* 7, 1945.

519.283 : 620.11 2109

**Statistical tools for controlling quality.** MANUELE, J., AND GOFFMAN, C. *Trans. Amer. Inst. Elect. Engrs*, 64, *pp.* 524–528, *July*, 1945.

519.283 : 677 : 539.216.1 *see Abstr.* 2836

519.4 : 548.1 *see Abstr.* 2569

519.41 2110

**On semigroups.** LEVI, F. W. *Bull. Calcutta Math. Soc.*, 36, *pp.* 141–146, *Dec.*, 1944.—Semigroups, i.e. systems admitting an associative multiplication,

are investigated from the point of view of the combinatorial theory. Of particular importance are *R*-semigroups which satisfy the condition *R* (of refinement). This states that if $a$, $c$ and $a'$, $c'$ are different pairs of elements such that $ac = a'c'$ then there exists an element $b$ satisfying at least one of the two pairs of conditions $a' = ab$, $c = bc'$ or $a = a'b$, $c' = bc$. It is shown that free semi-groups may be defined by axioms without reference to a system of letters out of which they are formed as words. The representation of a group as a factorgroup of a free semigroup is discussed. L. S. G.

523.12 ; 530.145 : 530.12 2111

**Kinematical relativity and the nebular red-shift.** DINGLE, H., MILNE, E. A. *Nature, Lond.*, 155, *pp.* 511–512, *April* 28, 1945.—Dingle enquires how it is possible in kinematical relativity to interpret the red-shift of the lines in nebular spectra as due to relative motion of the observer and the nebula when relative velocity can be transformed away by a suitable change of rate in the observer's clock. Whether the kinematical time-scale or the dynamical time-scale is used, *ad hoc* causes for the observed red-shift must apparently be introduced. In his reply, Milne states that the red-shift formula is a mathematical result of kinematical relativity and affirms that Dingle has not understood this theory. G. C. McV.

523.16 : 538.56.029.6 2112

**Cosmic static.** REBER, G. *Astrophys. J.*, 100, *pp.* 279–287, *Nov.*, 1944.—Naturally-occurring radio waves reaching the earth from space are captured by an equatorially-mounted 31 ft. sheet-metal mirror of focal length 20 ft. at whose focus are a pair of cone antennae tuned to 160 Mc/s (1·87 m.) which convert the electromagnetic energy into a.c. This passes to a 5-stage amplifier of 90 db gain, whose output is rectified and drives a pen recorder. As the earth rotates the (stationary) mirror sweeps out a pre-selected band of declination and the intensity of cosmic static is recorded against right ascension on the chart. Results from 200 charts obtained during 1943, plotted as constant-intensity lines on a celestial globe, outline the Milky Way with a max. in Sagittarius and minor peaks in Cygnus, Cassiopeia, Canis Major and Puppis. Little radiation emanates from points $>30°$ from the galactic plane, but measurable amounts come from the Sun. A. HU.

523.161 2113

**On the origin of smoke particles in the interstellar gas.** TER HAAR, D. *Astrophys. J.*, 100, *pp.* 288–299, *Nov.*, 1944.—A theory is developed to account for the formation of solid particles ("smoke") from interstellar gas. A formula is derived relating the temperature of a smoke particle to the number of atoms it contains, assuming it to be a heteropolar crystal. If the gaseous density is less than a certain characteristic value, the association of 2 atoms to form a diatomic molecule is determined by the probability of radiation capture. For higher densities the formation is analogous to that of liquid drops in supersaturated vapour. The discussion of the 2 cases shows that an optimum density (close to the characteristic density) exists for smoke formation. Rough estimates for the solar neighbourhood, assuming that condensation has proceeded for $10^9$ yr., suggest particles of max. size 2 000 Å, and total densities of smoke particles and of diatomic molecules which are consistent with observation. A. HU.

523.165 : 537.591 *see Abstr.* 2330

523.4 2114

**Titan: a satellite with an atmosphere.** KUIPER, G. P. *Astrophys. J.*, 100, *pp.* 378–383, *Nov.*, 1944.—Pluto and the largest 10 satellites in the solar system were examined spectroscopically on the 82-in. McDonald reflector, and many of the spectrograms are reproduced. Only Titan has a detectable atmosphere, though Triton and Pluto require further study. Titan's atmosphere is similar to that of Saturn, but of less optical thickness: the $CH_4$ bands at 6 190 Å and 7 260 Å show well, and the $NH_3$ band at 6 400 Å is suspected. The presence of hydrogen-rich gases on a body with so small a surface gravity indicates the evolution of the atmosphere after cooling of the satellite. Similar conclusions follow, though with less force, for the atmospheres of Mars, Venus and the earth. A. HU.

523.74 : 551.510.535 : 537.311.37 *see Abstr.* 2301

523.746 2115

**Provisional sunspot-numbers for December, 1944, to February, 1945.** BRUNNER, W. *Terr. Magn. Atmos. Elect.*, 50, *p.* 144, *June*, 1945.

523.746 2116

**Behaviour of ultra-violet and daylight rays in the solar cycle.** ASHWORTH, J. R. *Nature, Lond.*, 156, *p.* 115, *July* 28, 1945.

523.746 : 550.384 *see Abstr.* 2606, 2607

523.774 2117

**Solar concentration of the hydroxyl radical.** DWYER, R. J. *Astrophys. J.*, 100, *pp.* 300–301, *Nov.*, 1944.—An outstanding discrepancy betw. the OH concentration calculated from the observed strength of the OH lines in the spectrum of the solar disk and the concentration calculated thermodynamically is reduced by using an improved value (4·34 eV) instead of the previously accepted one (5·0 eV) for the dissociation energy of OH. A. HU.

523.78 : 537.591.1 *see Abstr.* 2334

523.801 2118

**Note on pressure relations within fluid spheres in equilibrium.** SEN, N. R. *Bull. Calcutta Math. Soc.*, 36, *pp.* 147–152, *Dec.*, 1944.—Three theorems are given concerning the mean pressure within fluid spheres, these following upon earlier work [Abstr. 2416 (1939)]. Some applications of the results to the theory of Stellar Structure are discussed. L. S. G.

523.832 : 523.851.3 *see Abstr.*

523.84 2119

**Observations of variable stars by the American Association of Variable Star Observers.** CAMPBELL, L. *Ann. Harv. Coll. Obs.*, 110, 7, *pp.* 219–260, *July*, 1944.

523.84 2120

**Observations of variable stars by the American Association of Variable Star Observers.** CAMPBELL, L. *Ann. Harv. Coll. Obs.*, 110, 8, *pp.* 261–329, *Sept.*, 1944.

523.841.1 2121

**Fourth outburst of Nova (T) Pyxidis.** CAMPBELL, L. *Science*, 101, *p.* 429, *April* 27, 1945.

523.841.37 2122

**On the anharmonic pulsations in the pulsation theory of the Cepheid variable.** ROY, S. K. *Bull. Calcutta Math. Soc.*, 36, *pp.* 109–121, *Dec.*, 1944.—The equations of motion of a pulsating star are written in Hamiltonian form and the 3rd order approx. to the solution is considered. The results are compared with those of Rosseland [Abstr. 47 (1944)] who neglected the third and higher order terms in the displacement. An examination is made of the fundamental node of oscillation and the effect of a small overtone on the fundamental. A complete solution is given in a special case. L. S. G.

523.841.9 2123

**The eclipsing system SX Cassiopeiae.** GAPOSCHKIN, S. *Astrophys. J.*, 100, *pp.* 221–229, *Nov.*, 1944.—The photographic light-curve of this variable is obtained from 2 046 Harvard patrol plates and compared with the visual light-curve. The curves indicate different durations of eclipse and of totality, and also different ellipticities. The radius of the A6 component is smaller at shorter wave-lengths. Comparison with Struve's spectroscopic observations [Abstr. 1251 (1944)] suggests that the blue component is surrounded by a thick asymmetrical atmosphere which probably envelops the whole system. It is suggested that other eclipsing variables show similar effects, and that modifications may be necessary in our views of stellar radii and thence of the internal constitution of stars. A. HU.

523.841.9 2124

**The eclipsing system RX Cassiopeiae.** GAPOSCHKIN, S. *Astrophys. J.*, 100, *pp.* 230–241, *Nov.*, 1944.—The photographic (2 037 observations) and visual (324 observations) light-curves of this variable are combined with Struve's spectroscopic results [Abstr. 2360 (1944)] to give relative and absolute dimensions of the system. A long-period intrinsic variation of range 0·46 mag. and period 517·6 days is superposed on the geometrical variation. An unprecedented difference of 0·16 mag. exists betw. the maxima. As with SX Cass [Abstr. 2123 (1945)], different radii are deduced from the photographic and visual curves, and an extensive gaseous envelope is indicated. A. HU.

523.841.9 2125

**The Wolf–Rayet eclipsing variable HV 11 086 = HD 214 419.** GAPOSCHKIN, S. *Astrophys. J.*, 100, *pp.* 242–250, *Nov.*, 1944.—This star, recently studied as a spectroscopic binary [Abstr. 2363 (1944)] is found from 1 795 Harvard patrol plates to be an eclipsing variable with a light curve of $\beta$ Lyrae type. Relative and absolute dimensions are deduced, and the W component is shown to be very similar in physical properties to the W component of V 444 Cygni [Abstr. 814 (1945)]. Its extended atmosphere, through which atoms are continuously ejected at high velocity, renders the ordinary conception of "radius" inapplicable, and the observed discrepancy betw. excitation and effective temperature is apparent only. A. HU.

523.841.9 2126

**The eclipsing star AR Monocerotis.** PAYNE-GAPOSCHKIN, C. *Astrophys. J.*, 100, *pp.* 251–254, *Nov.*, 1944.—The photographic light-curve of this $\beta$-Lyrae variable is obtained from 1 441 Harvard plates, and relative elements derived from this and a visual curve. The mean radii of the components appear to vary with wavelength, the photographic curve giving a total but the visual only a partial eclipse. Absolute dimensions are found by using a plausible mass-ratio, and temperatures are assumed to derive absolute magnitudes for the components. A. HU.

523.842 2127

**A report on new spectrographic material of 13 Ceti.** BAUER, C. A. *Astrophys. J.*, 100, *pp.* 302–310, *Nov.*, 1944.—This star is a visual double whose brighter component A is a one-spectrum spectroscopic binary. From 108 spectrograms taken at Yerkes betw. 1928 and 1944 the systemic velocity of A is shown to vary with the relative radial velocity of the fainter component B with respect to A, the correlation giving masses $M_A = 1{\cdot}8$, $M_B = 0{\cdot}6$ in solar units. No significant variations in the spectrum are found, but the spectroscopic period is improved. A. HU.

523.842.3 2128

**The spectroscopic orbit of AR Monocerotis.** SAHADE, J., AND CESCO, C. U. *Astrophys. J.*, 100, *pp.* 374–377, *Nov.*, 1944.—From 29 spectrograms taken on the 82-in. McDonald telescope over 3 consecutive cycles in 1944 the spectroscopic elements are deduced by applying Schlesinger's least-squares method to a preliminary orbit. At primary eclipse the K0 component, whose spectrum is the only one observed, is in front. The Ca II lines appear in emission and share the velocity variations of the K0 component; they presumably arise in an extended atmosphere around the K0 star. A. HU.

523.842.3 2129

**The Wolf–Rayet type spectroscopic binary HD 152 270.** STRUVE, O. *Astrophys. J.*, 100, *pp.* 384–387, *Nov.*, 1944.—This is the first WC star to be discovered as a spectroscopic binary. Its emission lines are broad and show an expansion velocity of about 2 000 km./sec. The blended emission feature at 4 647–4 686 Å. (C III, C IV, He II) shows an oscillation in wavelength of period 8·82 days. The central absorptions of the H lines vary in the same period but in opposite phase, and may arise from the second component of the system, which would then be of absorption O type. Approx. orbital elements are derived. A. HU.

523.851.3 : 523.832 2130

**The radial velocity of the Pleiades.** SMITH, B., AND STRUVE, O. *Astrophys. J.*, 100, *pp.* 360–373, *Nov.*, 1944.—From 237 spectrograms of 69 members of this cluster (down to apparent magnitude 9·0) the mean radial velocity is found to be +4·08 km./sec. A large systematic difference of radial velocity betw. members of high and those of low rotational velocity is unexplained. Only 2 spectroscopic binaries are found, though 8 more are suspected. The small difference found betw. external and internal mean errors in the velocities confirms that internal motions are small. No evidence is found that the velocities depend upon position in the cluster. The results are compared with other recent determinations, but no explanation is offered for appreciable discrepancies. A. HU.

523.852.3 : 523.874 *see Abstr.* 2133, 2134

523.872 2131

**Relation between colour index and effective wavelength from the observations of Hertzsprung and Vanderlinden.** SEARES, F. H., AND JOYNER, M. C. *Astrophys. J.*, 100, *pp.* 264–278, *Nov.*, 1944.—The relations obtained by Hertzsprung and by Vanderlinden betw. effective wavelength and colour index are recalibrated to the revised international colour system, and compared with the theoretical relation computed for black-body radiators in a previous paper [Abstr. 343 (1944)]. The regression formulae are given so that other extensive observations on the Pleiades and Praesepe by these authors may be reduced to the international system. The agreement is satisfactory, and computed effective wavelengths can therefore ordinarily be used. A. HU.

523.872 2132

**A change in the spectrum of 39ε Capricorni.** STRUVE, O., AND DEUTSCH, A. J. *Astrophys. J.*, 100, *p.* 390, *Nov.*, 1944.—The sharp absorption cores of the H lines in the spectrum of this B5 *pe* star disappeared during Sept., 1944, and at present the appearance is that of an ordinary B3*nn* star. The absorption line of Mg II at 4 481 Å also belongs to the variable shell spectrum and has disappeared. A. HU.

523.872 : 539.153.4 : 537.228.5 *see Abstr.* 2297, 2298

523.874 : 523.852.3 2133

**Red shift in the anagalactic nebulae.** SHNEIDEROV, A. J. *Nature, Lond.*, 155, *pp.* 332–333, *March* 17, 1945.—A photon emitted by a distant nebula has a mass which is acted upon by the gravitational field of the Galaxy. In order to satisfy the requirements of the law of gravitation, of the theory of relativity and of the conservation of energy, the observed frequency must differ from the emitted frequency, the velocity being kept const. by a wavelength adjustment so as to compensate for the variation due to the acceleration. This shift of wavelength increases with distance and is identified with the observed red-shift of the "expanding universe." A. HU.

523.874 : 523.852.3 2134

**Red shift in the anagalactic nebulae.** DEACON, E. L., AND EDGEWORTH, K. E. *Nature, Lond.*, 155, *pp.* 699–700, *June* 9, 1945.—The theory of Shneiderov [Abstr. 2133 (1945)] is criticized on the ground that an emitting nebula would exert on a photon a gravitational effect opposite and presumably nearly equal to that of the Galaxy. Two alternative explanations are offered: one reverses Shneiderov's mechanism and assumes that the Galaxy is smaller than most nebulae; the other suggests a change of frequency due to absorption in intergalactic space. A. HU.

523.877 2135

**The generalized Cowling model.** HARRISON, M. H. *Astrophys. J.*, 100, *pp.* 343–346, *Nov.*, 1944.—The Cowling model is generalized by considering stars in which the convective core and the point-source envelope have different mean molecular weights $\mu$, the ratio $\mu_c/\mu_e$ varying from 1 (the standard Cowling model) to 2. As the ratio increases, the convective core encloses less and less of the mass and radius, while the total radius and luminosity of the configuration increase. A. HU.

523.877 2136

**An approximate solar model on Bethe's law of energy generation.** SEN, N. R., AND BURMAN, U. R. *Astrophys. J.*, 100, *pp.* 347–354, *Nov.*, 1944.—The stellar equations of equilibrium are used in conjunction with Bethe's law in its strict exponential form to investigate the central density for an assigned composition and central temperature. Two central densities are found outside which the energy transfer is either purely radiative or purely convective. Betw. them a convective-radiative transfer satisfies the boundary conditions only for a unique central density. A stellar model of the latter type using a central temperature of $20 \times 10^6$°C. and a H content of 35% (He content = 0) gives a luminosity closely equal to that of the sun, a mass 7% larger and a radius 14% larger. A. HU.

523.877 213

**On the radiative equilibrium of a stellar atmosphere. IV.** CESCO, C. U., CHANDRASEKHAR, S., AND SAHADE, J. *Astrophys. J.*, 100, *pp.* 355–359, *Nov.*, 1944.—The problem of line formation discussed in a previous paper [Abstr. 829 (1945)] is solved numerically in the first 3 approximations, and tables for the residual intensity are given. The solution is compared with the standard Milne–Eddington approximation. A. HU.

526.7 213

**The international gravity formula.** LAMBERT, W. D. *Amer. J. Sci.*, 243–*A*, *pp.* 360–392, 1945. *Daily Vol.*—The gravity formula is developed from the constants of the International Spheroid of reference; then the formula resulting from an assumption of a fluid spheroid of reference of mass equal to that of the International Spheroid is developed and discussed. The conclusion that the departure from the result of the International Formula would be slight is illustrated by numerical examples. The Bruns term and the controversy occasioned by Hopfner's revival of Bruns' ideas are discussed. A longitude term is developed by means of spherical harmonics. Hypotheses advanced by geodesists are stated and the implications discussed.

527 : 538.7(09) *see Abstr.* 2361

53 21

**Physics in 1944.** OSGOOD, T. H. *J. Appl. Phys.*, 1, *pp.* 61–76, *Feb.*, 1945.—A review of research in Physics in 1944, the subjects discussed being X-rays, cosmic rays, nuclear disintegration, atmospheric showers, theory of counters, artificial disintegration, magnetic lens spectrometer [Abstr. 265 (1945)] and Newton's rings [Abstr. 1201 (1944)]. L. S.

53 : 541.64 *see Abstr.* 2523

53.081.7 21

**Preparation and physical constants of acetylenic compounds.** HENNE, A. L., AND GREENLEE, K. W. *J. Amer. Chem. Soc.*, 67, *pp.* 484–485, *March*, 1945.

53.089.6 : 531.718 *see Abstr.* 2157

530.1 21

**Unification of the physical fields.** SAXBY, F. L. *Nature, Lond.*, 155, *pp.* 609–610, *May* 19, 1945.—The author's theory of indeterminate space time is discussed in relation to Eddington's theory and some recent remarks by Schrödinger [Abstr. 86 (1945)].

530.12 : 530.145 : 523.12 *see Abstr.* 2111

530.12 : 530.145.6 21

**On the theory of the particle of spin $^3/_2$.** GINSBURG, V. *J. Phys., USSR*, 7, 3, *pp.* 115–128, 1943.

ie relativistic theory is developed in spinor-vector rm. This includes the equation of motion and the rresponding Lagrange function, found by Pauli and erz [Abstr. 44 (1940)]. Expressions for the current nsity, energy momentum tensor, angular momentum nsity tensor and spin projection operator are tained. A complete set of eigenfunctions of free otion is found and the interaction of the particle th an electromagnetic field, especially the radiation ld, is investigated by a perturbation method. The agnetic properties of the particle of spin $^3/_2$ and other particles is discussed. L. S. G.

30.12 : 531.18 : 621.392.1 2143

**Wave-guides and the special theory of relativity.** ERSHBERGER, W. D. *J. Appl. Phys.*, 16, *pp.* 465–468, *ug.*, 1945.—[Abstr. 2177 B (1945)].

30.12 : 539.152.1 2144

**Relativistic equations for particles of arbitrary spin.** HABHA, H. J. *Curr. Sci.*, 14, *pp.* 89–90, *April*, 1945.—n investigation is made of all possible equations of ie form $(p_k\alpha^k + \chi)\psi = 0$ where $p_k = ih\partial/\partial x^k$, is an arbitrary constant and the $\alpha^k (k = 1, \ldots 4)$ re matrices satisfying certain commutation rules. ncluded are equations equivalent to those given by Dirac [Abstr. 3489 (1936)], and by Fierz [Abstr. 983 1939)] for particles of any assigned spin. A set is lso included which is a generalization to higher spins f the scalar wave equation. L. S. G.

30.145 : 530.12 : 523.12 *see Abstr.* 2111

30.145.1 2145

**On the theory of excited spin states of elementary articles.** GINSBURG, V. *J. Phys. USSR*, 8, 1, *p.* 33–51, 1944.—A development of the relativistic heory of the particle ($^1/_2$, $^3/_2$). The cross-section for he scattering of light (or mesons) on the magnetic or quasi-magnetic) moment of such a particle increases t first with the energy as in the usual theory but becomes constant for photon energies $h\nu >> (m_3 - m_1)c^2$ where $m_1$ and $m_3$ are the rest-masses. Thus, the ntroduction of higher spin states leads to the cutting-off of the cross-section for scattering and to the ossibility of a non-contradictory consideration of the nteraction of the heavy particle's moment with the adiation and the meson field. The theory of the particle (1, 2) is also developed and this, together with the above theory, makes it possible to consider he excited states of the proton-neutron and the meson in a relativistic form. L. S. G.

530.145.6 : 530.12 *see Abstr.* 2142

530.145.6 : 539.153 *see Abstr.* 2370

530.19 : 537.226 : 536.2.01 : 621.315.21.029.5 2146

**The capacitance and thermal conductance of screened multi-pair systems in high-frequency cables.** CARSTEN, H. R. F. *J. Instn Elect. Engrs*, 92, *Part III*, *pp.* 93–104, *June*, 1945.—[Abstr. 1944 B (1945)].

531.1 : 612.76 2147

**Locomotor mechanics and occupation.** STEINDLER, A. *Trans. Amer. Soc. Mech. Engrs*, 67, *pp.* 167–175, *April*, 1945.—Calculation of the forces and work performed in certain locomotor acts is possible to a close approx. That of walking requires a total rate of from 0·12 to 0·23 kg. per horizontal metre-kg. The efficiency coefficient for walking is 33·5%. Daily expenditure of energy is divided into that required for one's occupation, energy spent during leisure time, basal metabolism and unused energy of food intake. Endurance and fatigue are also discussed as measures of efficiency. A criterion of efficiency is also applicable under pathological conditions and instances of this kind are given from different phases of orthopaedic reconstruction work. G. E. A.

531.18 : 621.392.1 : 530.12 *see Abstr.* 2143

531.19 : 536.77 : 548.7 *see Abstr.* 2575

531.2 : 624.15 2148

**An application of soil mechanics to a bridge foundation problem.** GODFREY, E. W. C. *J. Instn Engrs, Aust.*, 17, *pp.* 59–64, *March*, 1945.—Investigation of a proposed bridge across the Swan River, W.A., the piles to pass through 20 ft. of sand, their toes terminating 6 ft. above a clay bed. The bridge would be supported on a series of cofferdams, each of which would enclose 10 piles. Each pile would be safe at 17½ tons dead load and 25 tons combined dead and live load. The first part investigates the distribution of stress on the clay substratum, and the second endeavours to show that these stresses are safe and estimates the degree of settlement under the load. G. E. A.

531.22 2149

**The structural efficiency of wing covers.** DONOVAN, A. F., GOLAND, M., AND GOODIER, J. N. *J. Appl. Mech.*, 12, *A8–A12*, *March*, 1945.—Discusses rational criteria for evaluating the structural efficiencies of sheet-stiffener combinations and alternative constructions used for wing and other surfaces, and to determine the suitability of the available materials for panels of various proportions. The efficiency criteria require the determination of the ideal construction for such panels, and this is carried out. It is found that the primary requirement of the "best" material for the ideal design is a high strength/weight ratio (yield-stress/density). A diagram is given to determine the weights of panels of ideal design made of various materials, all to carry the same load.

531.224 2150

**The buckling of the webs of plate girders.** SPARKES, S. R., AND CORNFIELD, G. M. *J. Instn Civ. Engrs*, 24, *pp.* 59–61, *March*, 1945.—Tests were planned to cover the range between webs which fail by buckling and webs which fail by shear yielding. Two types of girder were used; in one, the webs were welded to the flanges, in the other, bolts were employed with flange angles. The girders were loaded centrally and vertical and lateral deflections were measured. No sudden change was observed at the buckling load. In the first type, the load, $W_r$, at which the graphs of load/(central deflection) ceased to be straight was determined with fair accuracy; in the second type, the graph was composed of a series of straight lines of slightly changing slopes, and $W_r$ could not be determined with accuracy. Girders with (web depth)/(web thickness) as high as 106 all failed by yielding, not buckling. G. E. A.

531.224 2151

**The slope deflection theory: derivation and application to simple frames.** THOMPSON, G. E. *J. Instn Civ. Engrs*, 24, *pp.* 62–67, *March*, 1945.—Slope deflection equations are derived as an introduction to the subject and two examples of the method of application are worked out completely. G. E. A.

531.252.3 2152

**Ellipses of inertia.** MORELLI, D. A. *J. Instn Engrs, Aust.*, 17, *pp.* 66–67, *March*, 1945.—The customary momental ellipse and ellipse of gyration are really both ellipses of gyration, since the quantity determined from the construction is the radius of gyration. An even closer parallel exists between the ellipse of stress and what is here defined as the "ellipse of inertia," which construction is developed to give a simple graphical solution of problems in unsymmetrical bending. G. F. F.

531.383 : 629.135 : 621.3.083.7 : 538.74 *see Abstr.* 2362

531.51 : 539.152.1 *see Abstr.* 2368

531.66 : 537.122 *see Abstr.* 2290

531.714.2 2153

**"Microptic" vertical measuring machine.** *Engineering*, 159, *pp.* 246–248, *March* 30, 1945.—A new type of vertical measuring machine is described in which no multiplying devices are employed, the actual movement of the measuring contact being read directly by means of a microscope. Its normal capacity covers measurements from zero to 4 in., the reading being made directly to within 0·00005 in. and by estimation to 0·00001 in. For consistent and accurate readings, temperature control is necessary. The main scale is engraved on a block of glass and a graticule scale gives readings to 0·01 in., a micrometer scale, visible in one half of the microscope field, giving the figures in the next 3 decimal places. A. W.

531.717 2154

**End point indication of the B.N.F. jet test for measurement of thickness of zinc coatings on steel.** CLARKE, S. G. *J. Electrodepos. Tech. Soc.*, 20, *p.* 75, 1945.

531.717.1 : 534.321.9 2155

**Supersonic measurement of metal thickness.** ERWIN, W. S. *Iron Age*, *pp.* 59–61, *Nov.* 9, 1944. *Steel*, *pp.* 133, 188, *et seq.*, *March* 5, 1945.—The "Sonigage" measures the thickness of metal sections where one of the surfaces is inaccessible. It was originally designed for the quick inspection of hollow steel propeller blades and consists of a simple variable-frequency electronic oscillator and a quartz crystal for converting this electrical energy into mechanical vibrations. The quartz crystal is placed in contact with the material being measured and the oscillator tuned to the resonant frequency of the work. An accuracy of 2% for thickness from 0·02 in. to 0·4 in. is claimed. M.-V.

531.717.1 : 621.317.39 2156

**Checking the thickness of cylinders by electrical methods.** THORNTON, B. M. *Machinery, Lond.*, *pp.* 9–11, *July* 5, 1945.—[Abstr. 2035 B (1945)].

531.718 : 53.089.6 2157

**Measurement of long end-gauges by comparison with precision line standards.** ARREGGER, C. E. *Canad. J. Res. F*, 23, *pp.* 185–191, *May*, 1945.—The comparison of end-gauges is made by "wringing" short blocks to each end, with lines to convert them to end-gauges. 20-in. and 10-in. end-gauges were compared in turn with a metre standard, using a microscope line comparator as a transfer. Precautions to ensure max. accuracy are detailed. The greatest deviation from the mean measurement was less than $2\mu$. Comparisons between the rules agreed to within $10^{-5}$ in. E. H. W. B.

531.718 : 548.1 215

**A spherical template for drilling balls for crysta structure models.** WOOSTER, W. A., AND COLE, R *J. Sci. Instrum.*, 22, *p.* 130, *July*, 1945.

531.732 215

**A simple volumeter.** SIMPSON, W. F. *Science*, 101 *pp.* 443–444, *April* 27, 1945.—The volumeter wa made from a wide-mouthed glass-stoppered bottle A hole 10 mm. dia. was drilled down through th glass stopper. A 10 cm.³ serological pipette graduate in tenths was then cemented into the hole, mouth en down, by means of plaster of Paris. Another hole o the same diameter was drilled through the side of th bottle 15 mm. from the bottom and into this hole wa inserted a rubber stopper. The tip of a 20 cm.³ Lue syringe was inserted firmly into a small hole bore through the rubber stopper.

531.743 : 548.73 *see Abstr.* 2588

531.754 : 625.8 : 620.172.212 216

**The use of mechanical tests in the design of bituminou road-surfacing mixtures. I. Dense tar surfacings** LEE, A. R., AND RIGDEN, P. J. *J. Soc. Chem. Ind.*, 64 *pp.* 153–161, *June*, 1945.—[Abstr. 1816 B (1945)].

531.758 216

**An apparatus for the measurement of vapour densities** SIMONS, J. H., AND RITTER, H. L. *Rev. Sci. Instrum.* 16, *pp.* 23–25, *Feb.*, 1945.—The apparatus consist essentially of a glass bulb connected to a long sealed glass tube containing the sample. The bulb and tub are located in separate thermostats, the former main tained at the higher temperature. Sufficient liquid i introduced to fill the bulb of vol. $V$ with saturate vapour of density $d$ (at bulb temperature and pressure equal to the vapour pressure of the liquid) and leave a measurable volume, $V_L$, of liquid of density $\rho$ condensed in the tube. Then $d = (m - V_L\rho)/V$ where $m$ is the mass of the charge corrected for th vapour in the connecting tube between the bulb and burette. Details are given of auxilliary experiments whereby corrections can be obtained for surface adsorption of the vapour. R. W. P

531.761 : 621.317.39 2162

**Process timer.** *Industr. Equipm. News*, 12, *p.* 9 *April*, 1944. *Abstr. in Biol. Abstr.*, 18, 15632, *Oct.* 1944.—[Abstr. 2036 B (1945)].

531.761 : 621.317.39 216

**Timing instrument.** *Industr. Equipm. News*, 12 *p.* 102, *July*, 1944. *Abstr. in Biol. Abstr.*, 18 15437, *Oct.*, 1944.—This instrument has bee developed for applications such as measuring pro jectile velocity, checking watch rate, camera shutte movement, etc. It reads increments of time to $10^{-5}$ sec to max. interval of 0·0999 sec. An electronic tub acts as the counting element with a 100 kc/s crysta controlled oscillator generating the initial counting rate when an electronic switch or gate is actuated by a pulse from the initiation of the time interval. A second pulse generated by the termination of the time interval turns off the gate and leaves a count on a panel of neon lamps. The instrument operates on an input from 100–125 V 60 c/s source and uses 27 electronic tubes. C. J. G.

531.78 : 621.317.39 2164

**Strain-gauge amplifier.** BRANSON, N. G. *Gen.*

*Elect. Rev.*, 48, *pp.* 55–58, *April*, 1945.—[Abstr. 2038 B (1945)].

531.787.2 2165

**A tympanometer.** KLEIBER, M. *Rev. Sci. Instrum.*, 16, *pp.* 79–81, *April*, 1945.—The instrument described measures the pressure of gases or liquids that cause bulging of an elastic membrane. The results are independent of the stresses in the membrane. The tympanometer is particularly adapted to measuring abdominal gas pressure, without injury to animals.

531.787.7 : 533.41 2166

**Combined manometer-barometer for distillation.** ROBERTSON, G. R. *Industr. Engng Chem.* (*Analyt. Edit.*), 17, *pp.* 238–239, *April*, 1945.

531.787.9 2167

**Electric manometer.** *Industr. Equipm. News*, 12, *p.* 99, *June*, 1944. *Abstr. in Biol. Abstr.*, 18, 15436, *Oct.*, 1944.—A Wheatstone bridge circuit is used to read pressure in terms of water-column in. and fractions with accuracy to $\pm 0{\cdot}1\%$ on 100 in. range. It is available in min. range of 0 to 5 in., max. 0 to 100 in. C. J. G.

532.13 : 532.72 : 541.68 2168

**The influence of molecular flexibility on the intrinsic viscosity, sedimentation, and diffusion of high polymers.** SIMHA, R. *J. Chem. Phys.*, 13, *pp.* 188–195, *May*, 1945.—Expressions for the mean square separation of chain ends and modifications of the formula for an ideal coil are discussed and an interpretation of the modified Staudinger rule given. It relates the exponent $a$ of the mol. wt. to a flexibility parameter $p$ of the chain in a given solvent, varying between 0 and 1. Recent data on polystyrene and on cellulose nitrate are analysed. By means of the frictional ratio $f/f_0$, the sedimentation constant $s$ and the diffusion constant $D$, respectively, are connected with the degree of polymerization in terms of $p$. The limiting dependence of sedimentation and diffusion rate upon mol. wt. for a straight chain and an ideal coil is also found. A comparison shows agreement between values for $p$ found from intrinsic viscosity and those determined from sedimentation or diffusion rates, for certain cellulose esters and starch derivatives. Effects of solvent and of inhomogeneity in respect to mol. wt. are discussed briefly.

532.13 : 535.32 2169

**A relation between viscosity and refractive index.** LAGEMANN, R. T. *J. Amer. Chem. Soc.*, 67, *pp.* 498–499, *March*, 1945.—The linear relation $I = aR + b$ holds for the liquid members of all homologous series where $I$ is the viscosity constant of Souders, $R$ is the molecular refraction and $a$ and $b$ are constants. For all the series examined $a$ is almost const. (12 approx.), while $b$ varies. The linear relation applies to the ethylene halides, but the value of $a$ is different from that in the homologous series. W. R. A.

532.13 : 541.141.12 *see Abstr.* 2487

532.13 : 661.713 2170

**Viscosity and molecular weight. IV. Acid and basic methods.** COPPICK, S. *Paper Tr. J.*, 120, *TAPPI Sect.*, *pp.* 7–10, *Jan.* 4, 1945.—Determinations of the viscosity of cellulose in an alkaline medium are open to error owing to the resulting instability of dialdehyde and ester groups produced by oxidation. It is now possible to nitrate cellulose without appreciably altering its chain length, and the viscosity of the resulting product is measured in an organic solvent. Comparisons of this method with the cuprammonium and cupriethylene diamine methods show that it is more reliable for celluloses containing residual lignin; its range is wider and includes both raw and uncooked materials. Non-cellulosic encrustants interfere with the dissolution of the polysaccharide to such an extent as to produce an erroneous picture of the degradation which occurs during the purification of wood cellulose. By suitable calibration, the nitrate method may be correlated with the TAPPI standard cuprammonium method. The average degree of polymerization for the carbohydrates in overcooked wood pulp is 1 400 for aspen and 1 600 for white pine. J. G.

532.13 : 661.713 2171

**Cuprammonium viscosity of cellulose using the Hoeppler viscosimeter.** HISEY, W. O., AND BRANDON, C. E. *Paper Tr. J.*, 120, *TAPPI Sect.*, *pp.* 11–20, *Jan.* 11, *and pp.* 21–24, *Jan.* 18, 1945.—The Hoeppler (falling ball type) viscosimeter is satisfactory for measuring the viscosity of solutions of cellulose in cuprammonium. It has the advantages that a low pulp conc. can be used, thereby reducing the error of measurement; the time of fall is easily determined (because of the large ball used); and the same solution may be tested several times. The error is approx. 50% of that of the standard TAPPI (T206 m) test. Disadvantages are that the dispersion must be made separately and transferred to the viscosimeter; and that when a glass ball is used, high results are obtained on repeating the test on the same solution, although this error does not occur with a steel ball. The results are examined statistically, and the effects of variations in wheel speed, dispersion time, and the Cu and pulp conc. are studied. On an average, the TAPPI method gives results 7·5 and 34·3% higher than those obtained with the glass and steel balls, respectively; the difference is probably due to the plasticity of the solution. The sp. gr. of the TAPPI dispersion is 0·945 and not 0·96, as given in the TAPPI standard; and the TAPPI tolerance for the $NH_3$ conc. is too large for accurate work. The time required for the dispersion of the pulp in the TAPPI standard cuprammonium can be reduced to 5 min. by using a wheel speed of 29·4 r.p.m., a pulp concn. of 0·25%. The use of inert gases is eliminated by filling the tube as completely as possible, and transferring with the aid of air pressure. J. G.

532.13 : 666.1 : 539.32 *see Abstr.* 2403

532.133 : 532.74 2172

**Fluidity and molecular structure.** THOMAS, L. H. *Nature, Lond.*, 155, *pp.* 365–366, *March* 24, 1945.—Proposes the relationship $\log \phi = a \log p/p_c + d$, where $\phi$ is the fluidity of a liquid at the vapour pressure $p$, $p_c$ the critical pressure, and $a$ and $d$ are constants. Putting $p = p_c$, then $d = \log \phi_c$, and we can write: $\log \phi/\phi_c = a \log p/p_c$ or $\phi/\phi_c = (p/p_c)^a$.

532.133 : 539.501 2173

**An inorganic "bouncing putty."** HANNA, D. L. *Science*, 101, *p.* 407, *April* 20, 1945.—A sample of sodium silicate, obtained from a dilute solution by slowly drying for several months, containing 10·9% $Na_2O$, 35·0% $SiO_2$ and 54% $H_2O$, a transparent

rubbery liquid, could be shaped into a ball and bounced off a hard surface. It flattens out slowly if placed on a table. The viscosity is $1{\cdot}1 \times 10^6$ poises at 19°C., independent of the rate of shear.

532.133 : 541.182.6 2174

**Theory of viscosity of concentrated suspensions.** VAND, V. *Nature, Lond.*, 155, *pp.* 364–365, *March* 24, 1945.—Einstein's formula is extended to higher concentrations and the equation tested with a suspension of glass spheres in two Ostwald and a Couette apparatus. Agreement is satisfactory up to 37% conc.

532.137 2175

**A capillary viscometer with variable rate of shear.** DAVIES, C. N. *Rev. Sci. Instrum.*, 16, *p.* 98, *April*, 1945.

532.511 2176

**On the hydrodynamics of helium II.** LANDAU, L. *J. Phys., USSR*, 8, 1, *pp.* 1–3, 1944.—A system of hydrodynamic equations may be established which describes macroscopically the movement of helium II. Associated with the motion are 2 velocities—the "superfluid" movement, $v_s$, and the normal movement, $v_n$. As in classical hydrodynamics, the former is given by Laplace's equation, $\Delta\phi_s = 0$, where $v_s = \text{grad}\,\phi_s$, and $v_n$ is given by the Napier–Stokes equation. The distribution of pressure and temperature may also be obtained. L. S. G.

532.516 : 539.62 *see Abstr.* 2437

532.529 : 622.32 2177

**The production histories of oil-producing gas-drive reservoirs.** MUSKAT, M. *J. Appl. Phys.*, 16, *pp.* 147–159, *March*, 1945.—A theory has been developed for predicting the behaviour of solution gas-drive oil-producing reservoirs, on the basis of previously established empirical laws on the flow of heterogeneous fluids through porous media. Treatments are given both for the simple pressure depletion history without gas injection, and those for systems in which gas is injected during the course of oil production. The specific results provided by the theoretical analysis included the ultimate oil recovery, and the pressure decline, gas-oil ratio, and productivity factor histories. Two types of gas injection have been considered, namely: (1) that in which the returned gas is supposed to diffuse through and be produced continuously with the oil zone; and (2) that in which the injected gas remains locked in the gas cap, which merely expands as oil production and gas injection proceed. In the latter case the rate of growth of the gas cap is also obtained as a function of the cumulative oil recovery. The theory is illustrated by a numerical example of a hypothetical virgin oil reservoir with an original pressure of 2 500 p.s.i. producing by gas-drive and with no initial gas cap. H. H. HO.

532.57 : 591.112 2178

**Apparatus for continuous cross-transfusion or for continuous mean blood flow measurement.** DENISON, A. B., AND GREEN, H. D. *Rev. Sci. Instrum.*, 16, *pp.* 95–97, *April*, 1945.—The apparatus consists of a flowmeter and a control circuit. The former is composed of two vertical tubes and a pair of 3-way stopcocks. These stopcocks are so arranged that blood enters the bottom of one of the tubes, thus displacing oil into the other tube, which in turn drives blood out of the bottom of it.

532.57 : 621.187.2 2179

**Circulation in steam boilers.** WALKER, V. *Elect. Times*, 108, *pp.* 205–207, *Aug.* 16, 1945.

532.612 : 532.77 2180

**Surface tension of solutions.** SCHUCHOWITZKY, A. A. *Nature, Lond.*, 155, *p.* 333, *March* 17, 1945.—[See Abstr. 1767 (1944)].

532.612 : 532.77 : 536.77 2181

**Statistical thermodynamics of the surface of a regular solution.** GUGGENHEIM, E. A. *Trans. Faraday Soc.*, 45, *pp.* 150–156, *March*, 1945.—It is assumed that the molecules at the surface are packed in the same manner as in the bulk, making the same contributions per pair of neighbours to the potential energy, and that the difference in compaction from that of the bulk is confined to a single layer of molecules at the surface. On this assumption Fowler's technique [see Abstr. 3527 (1938)] is used for the construction of the grand partition function of a binary regular solution. From this the dependence of surface tension on the composition is deduced. For the special case where the mixing energy is zero the regular solution becomes a perfect solution and the equation when simplified in this way is compared with those derived by Schuchowitzky (*Acta Physicochimica USSR*, 19, 176, 1944) and by Belton and Evans [Abstr. 869 (1945)], and is found to be equivalent but more symmetrical in form. R. W. P.

532.612.08 2182

**Effect of the rate of trickle on the mass of the drop.** KELKAR, V. N. *Curr. Sci.*, 14, *p.* 99, *April*, 1945.—For small rates of trickle, the mass of the drop increases slowly, but for larger rates it increases rapidly to large values when the discrete drops are about to merge into a continuous jet. If $a$ represents the equivalent acceleration of the liquid when the rate of trickle is $n$ drops per min. and $m$ is the corresponding mass of the drop, we may write

$$m(g - a) = 3{\cdot}8rT = m_0 g \quad \therefore m(1 - a/g) = m_0$$

We write $m[1 - f(n)] - m_0$ where $f(n)$ probably has the form $kn^x$ where $k$ and $x$ are constants.

532.613.4 2183

**Existence of time-dependence for interfacial tension of solutions.** ALEXANDER, A. E., AND RIDEAL, E. K. *Nature, Lond.*, 155, *p.* 18, *Jan.* 6, 1945.—Ward and Tordai [Abstr. 129 (1945)] have recently pointed out that the interfacial tension between water and hexane solutions of lauric acid attains equilibrium at an anomalously slow rate, probably arising from a process of high activation energy being involved subsequent to the diffusion of solute molecules to the interface. The authors suggest that the polar groups in the dimer of the monomer-dimer association which exists would be largely screened, rendering the dimer completely ineffective for bringing about equilibrium. With the monomer, however, this particular restriction would not exist, and the observed slow rate would then arise from the small proportion of fatty acid existing in the monomeric state. The time required for interfacial equilibrium should therefore decrease with decreasing molecular association in the hydrocarbon medium, and this is found to occur with solutions of palmitic acid and of an oil-soluble detergent (Aerosol OT) in benzene, nitrobenzene and nujol. This

uggested explanation, if confirmed by further work, would provide another means of estimating the degree of association of polar compounds in hydrocarbon media, and hence of equilibrium constants and heats of association. H. H. HO.

532.64.08 : 532.696.1 2184

**A tensiometric method for evaluating surface wettability by measurement of the contact angle.** WAKEHAM, H., AND SKAU, E. L. *J. Amer. Chem. Soc.*, 67, *pp.* 268–272, *Feb.*, 1945.—Surface wettability has been evaluated by tensiometric measurement of the contact angle, using an ordinary interfacial tensiometer. Contact angles derived theoretically agree with values derived experimentally. Applications of the method to measurement of contact angles of water on fabric and paper samples are illustrated, and precautions and sources of error are discussed. W. R. A.

532.685 : 532.692 *see Abstr.* 2185

532.692 : 532.685 2185

**On film formation of water flowing through thin cracks.** MEYEROTT, R., AND MARGENAU, H. *Amer. J. Sci.*, 243, *pp.* 192–196, *April*, 1945.—The decrease with time in the flow of water through thin cracks was found to depend on the amount of flow, and to be due to the obstruction caused by the formation of small air bubbles on fractures or minute irregularities on the surfaces bounding the flow. N. M. B.

532.694.1 = 3 2186

**On concentration functions in the foaming of partially foamable solutions. I.** BREITNER, H. J. *Kolloid Z.*, 100, *pp.* 335–349, *Sept.*, 1942.—Methods were developed for a quantitative investigation of foam formation, especially for producing bubbles of equal and maximum diameters, for facilitating the tapping of the foam column at different heights, for protecting the foam against evaporation, and for controlled conversion of the foam to "spumate," i.e. that part of the solution which has passed through the foam stage. R. N.

532.696.1 : 532.64.08 *see Abstr.* 2184

532.696.1 : 539.217.3 : 677.01 2187

**The water repellency of fabrics and a new water repellency test.** BAXTER, S., AND CASSIE, A. B. D. *J. Text. Inst., Manchr*, 36, *T67–T90*, *April*, 1945.—An analysis is made of the properties measured by different tests and the results are compared with the mechanism by which rain is absorbed by a fabric. The problem is examined mathematically and data are tabulated and plotted. A new apparatus designed to measure a fundamental property of rain resistant fabrics is described. Results obtained by this test, and data reported for various fabrics, together with a study of natural water repellent surfaces, such as ducks' feathers, show that the conventional water repellent fabric has a structure far from ideal. The theoretically ideal structure for a water repellent surface is explained. [see Abstr. 515 (1945)]. N. M. B.

532.71 : 541.182.6.046 *see Abstr.* 2501

532.72 2188

**The diffusivities of concentrated sucrose solutions.** VAN HOOK, A., AND RUSSELL, H. D. *J. Amer. Chem. Soc.*, 67, *pp.* 370–372, *March*, 1945.—The diffusivities of aq. sucrose solutions diminish linearly from conc. >1 *M* to at least the saturation conc. The Stokes–Einstein inverse diffusivity-viscosity relation does not explain the results obtained. The plot of differential coefficient of 0·1 *M* KCl against 1/T shows slight convexity. W. R. A.

532.72 2189

**The microdiffusiometer and its application to the study of the molecular constitution of liquids.** FÜRTH, R. *J. Sci. Instrum.*, 22, *pp.* 61–65, *April*, 1945.—The difficulties of measurements, owing to extreme slowness of diffusion, and the limitations of available formulae and consequent divergence of data are considered. In order to use diffusion measurements to investigate the structure of liquids and liquid solutions, the dependence of the diffusion coeff. on conc. is determined by a new method. If the dimensions of the diffusing system are reduced by a factor $n$, the time of diffusion will be reduced by a factor $n^2$. Hence micro-experiments will reduce the duration to an extent over which vibration and temperature changes will have negligible effect. In the method described, a comparison chamber is used in the case of coloured liquids, and index-of-refraction observations in the case of colourless liquids. A special instrument (microdiffusiometer) was evolved for measurements by both methods. Results of various investigations are reviewed. N. M. B.

532.72 : 541.68 : 532.13 *see Abstr.* 2168

532.73 : 536.77 *see Abstr.* 2287

532.73–3 2190

**Dichlorodiphenyltrichloroethane. I. Solubility in various solvents.** GUNTHER, F. A. *J. Amer. Chem. Soc.*, 67, *pp.* 189–190, *Feb.*, 1945.—Values of the wt.-% solubilities of DDT in acetone, benzene, carbon tetrachloride, chloroform, dioxane, ether, ethanol (95 wt.-%), petrol ether (30–60°) and pyridine for temperatures between 0° and 48° have been determined. The data show that benzene is the best "stripping" solvent for DDT at room temperature. W. R. A.

532.733 : 541.123.33 2191

**The solvent effect of lithium nitrate on zinc acetate in acetic acid.** GRISWOLD, E., ASH, A., AND MCREYNOLDS, L. *J. Amer. Chem. Soc.*, 67, *pp.* 372–374, *March*, 1945.—The solubility of $Zn(OAc)_2$ in solutions of $LiNO_3$ in acetic acid is determined at different temperatures and concs. The solubility increases with increasing conc. of $LiNO_3$, the solvent effect of which is, however, considerably weaker than that of NaOAc or $NH_4OAc$ on $Zn(OAc)_2$. The solvent effect of $LiNO_3$ is attributed chiefly to salt effect. W. R. A.

532.739.2 2192

**The solubility of some salts in ethylenediamine, monoethanolamine and ethylene glycol.** ISBIN, H. S., AND KOBE, K. A. *J. Amer. Chem. Soc.*, 67, *pp.* 464–465, *March*, 1945.—The solubility of 25 inorganic salts in ethylenediamine, monoethanolamine and ethylene glycol has been determined at 25°. Liquid $NH_3/H_2O$ solubility characteristics approximate to the corresponding ethylenediamine/ethylene glycol ratios. W. R. A.

532.74 : 532.133 *see Abstr.* 2172

532.74 : 541.132 : 537.311 *see Abstr.* 2300

532.77 : 532.612 *see Abstr.* 2180

532.77 : 536.77 : 532.612 *see Abstr.* 2181

532.782 : 669.018 2193

**The solubility of manganese in aluminium.** BUTCHERS, E., AND HUME-ROTHERY, W. *J. Inst. Met.*, 71, *pp.* 87–91, *Feb.*, 1945.—The solubility above 500°C. was studied by microscopic methods, using alloys prepared from very pure metals. The max. solubility at the 658·5°C. eutectic horizontal is 1·32% Mn, and is lower than values given by previous investigators, although at 500°C. there is good agreement. Reasons for these differences are discussed. [See Abstr. 115, 116 (1944)].

533.21 : 536.411 : 536.71 *see Abstr.* 2285

533.4 : 518.3 2194

**Thermobarometer. Quick and exact conversion of gas volumes into weight.** BERL, E., BERL, W. G., AND STERBUTZEL, G. A. *Industr. Engng Chem.* (*Analyt. Edit.*), 17, *pp.* 166–168, *March*, 1945.—A thermobarometer is described for use in the conversion to N.T.P. of gas volumes obtained in analytical determinations. Equations for further conversion to weight per cent are given together with tabulated conversion factors for various gaseous products. The use of the instrument for dry and saturated gases is described and a nomogram applicable to the two cases is included. R. W. P.

533.41 : 531.787.7 *see Abstr.* 2166

533.52 : 542.4 2195

**New chemical apparatus—vacuum pump.** *Chem. Age, Lond.*, *pp.* 9–10, *Jan.* 6, 1945.—The compact portable unit incorporates a 3-stage mercury-vapour diffusion pump and can give a vacuum of the order of $10^{-6}$ mm. Hg. A McLeod gauge is fitted. Other equipments described are a portable electric hot-plate for laboratory use and an apparatus for exposing samples to artificial conditions of sunlight and atmospheric humidity. M.-V.

533.6.011.31 : 621.67 2196

**A study of the theory of axial-flow pumps.** WISLICENUS, G. F. *Trans. Amer. Soc. Mech. Engrs*, 67, *pp.* 451–470, *Aug.*, 1945.—[Abstr. 2251 B (1945)].

533.6.013.6 2197

**Turning in a wind.** ETKIN, B. *Engng J., Montreal*, 28, *p.* 160, *March*, 1945.—An analysis of the problem of an aircraft turning in a wind is presented. The change in the kinetic energy of the machine referred to earth axes is shown to be caused by work done on the aircraft by the air. The change in groundspeed is computed from a consideration of the same force which does the work.

534.01 2198

**An apparatus for demonstrating standing waves.** PRYOR, M. J. *Amer. J. Phys.*, 13, *pp.* 110–111, *April*, 1945.

534.014 : 621–752 2199

**Response of elastically mounted bodies to rapid accelerations.** MANLEY, R. G. *Engineering*, 159, *pp.* 321–323, *April* 27, 1945.

534.111 2200

**The determination of critical speeds, natural frequencies and modes of vibration by means of basic functions.** INGLIS, C. E. *Trans. N.E. Cst Instn Engrs Shipb.*, *pp.* 111–136, *Jan.*, 1945.—The author develops a method for calculating critical speeds and modes of vibration of shafts and natural frequencies and modes of vibration of turbine blades. No matter what form of directional constraint is exerted by the end supports, or how variable in section the shaft or blade may be, the determination of these quantities can be reduced to the solution of 2 linear simultaneous equations which always take the same general form and are of universal application. The method depends on expressing the mode of rotation or vibration in terms of basic functions, a basic function being the distribution of load on a beam of uniform cross-section which produces a similar curve of deflection. M.-V.

534.114 : 621.317.36 2201

**Checking electrically maintained tuning forks.** BAXTER, H. W. *J. Sci. Instrum.*, 22, *p.* 130, *July*, 1945.—[Abstr. 2033 B (1945)].

534.13 2202

**"Singing" corner vanes.** BATCHELOR, G. K., AND TOWNSEND, A. A. *Nature, Lond.*, 155, *p.* 236, *Feb.* 24, 1945.—A study of the "singing" heard in the concrete wind tunnel of the University of Sydney. The corner vanes are of the constant-width annulus type of reinforced concrete, and 7 notes were observed with frequencies from 246 to 420. These had max. intensity in the centre of the space between the cascades where there is a strong chordwise standing wave excited by either torsional or flexural vibration of the turning vanes and maintained by the alternate shedding of eddies from the trailing edges of the vanes. The singing effect is assisted by the closeness of the frequencies of the vanes to those of the air column between the vanes. Air speeds in the range 35–44 ft./s. are critical for exciting the air resonance. G. E. A.

534.13 : 621.396.621.54 = 3 2203

**Acoustic feed-back in short-wave reception with superheterodyne receivers, and its prevention.** PILTZ, W. *Elekt. Nachr.-Tech.* [*ENT*], 20, *pp.* 17–27, *Jan.*, 1943.—[Abstr. 2215 B (1945)].

534.142.4 2204

**Singing flames.** JONES, A. T. *J. Acoust. Soc. Amer.*, 16, *pp.* 254–266, *April*, 1945.—[See Abstr. 1329 (1945)]. The flames considered are those which maintain vibration of the air in a surrounding air tube. Standing waves in the gas tube are not essential for the maintenance of these vibrations. Rayleigh's theory is modified to take into account the increase in viscosity of the gas in the flame orifice, and the progressive waves that run downward through the gas tube. Conditions for maintenance are the time taken by the flame gases in rising from the orifice to the top of the flame, the size of the flame and its position in the air tube. G. E. A.

534.23 2205

**Acoustic intensity distribution from a "piston" source.** WILLIAMS, A. O., JR., AND LABAW, L. W. *J. Acoust. Soc. Amer.*, 16, *pp.* 231–236, *April*, 1945.—A fairly simple and accurate approximation for the above is derived, which holds at points near the axis of a narrow beam from a piezo-electric quartz for certain ranges of wavelengths and piston sizes. Some measurements made with a torsion disc radiometer and a Rochelle salt microphone are adduced in support of the theory. G. E. A.

534.321.9 : 531.717.1 *see Abstr.* 2155

534.321.9 : 539.32 : 548.0 *see Abstr.* 2565

534.321.9 : 548.0 *see Abstr.* 2560

534.321.9 : 578.088.9 2206

**A new method for the generation and use of focused ultrasound in experimental biology.** LYNN, J. G., ZWEMER, R. L., CHICK, A. J., AND MILLER, A. E. *J. Gen. Physiol.*, 26, *pp.* 179–193, *Nov.*, 1942.—This is an application of the method of Grützmacher [Abstr. 3278 (1936)] designed to project a focused beam of ultrasonic vibrations into fresh tissue blocks and into the tissues and organs of living animals, so as to produce a max. of change at the focus with a min. of change in the intervening tissues traversed by the beam. The r.f. voltage is applied across the faces of a *x*-cut concave quartz crystal, ground to a natural frequency of 835 kc/s. The generator is housed in a transparent bakelite container supported by a ball and socket joint. The container is sealed above by a cellophane diaphragm, against which biological specimens are placed; its interior is filled with clear transformer oil in which the quartz crystal vibrates. This is mounted by its bevelled edge on a neoprene gasket attached to the margins of a bakelite cup, the interior of which forms an air-field chamber behind the crystal. Electrical leads connect with spring contacts on the two aluminized faces of the crystal. C. J. G.

534.37 2207

**Attenuation of sound in lined circular ducts.** MOLLOY, C. T., AND HONIGMAN, E. *J. Acoust. Soc. Amer.*, 16, *pp.* 267–272, *April*, 1945.—Tables and graphs are provided for the calculation of the attenuation. This has been made feasible by the recent publication of tables of Bessel functions for complex arguments. A brief development of the basic theory is added. G. E. A.

534.37 : 518.3 2208

**Kneser's sound absorption nomogram and other charts.** PIELEMEIER, W. H. *J. Acoust. Soc. Amer.*, 16, *pp.* 273–274, *April*, 1945.—The author plots the max. value of the molecular absorption per wavelength as a function of the temperature, and obtains agreement with the theoretical values found by Kneser, the measured values of Knötzel and Kneser, and those of Knudsen. Kneser's nomogram is modified so that the molecular absorption can be found for ordinary conditions of temperature, humidity and sound frequency; an example is given. G. E. A.

534.415 : 621.386.83 2209

**Analysis of the target condition of rotating anode tubes with a spinning top.** WHITELEATHER, J. E. *Amer. J. Roentgenol. Radium Ther.*, 53, *pp.* 514–516, *May*, 1945.—[Abstr. 2168 B (1945)].

534.782 : 621.317.341.1 : 621.395.8 2210

**The measurement of crosstalk in telephone apparatus with an artificial voice and a weighted transmission measuring set.** CRUTCH, L. S. *P.O. Elect. Engrs' J.*, 38, *pp.* 48–51, *July*, 1945.—[Abstr. 2189 (1945)].

534.837 2211

**The reduction of noise from air-conditioning systems.** KING, A. J. *Metrop.-Vick. Gaz.*, 21, *pp.* 61–68, *April*, 1945.—[Abstr. 2402 (1944)].

534.838.2 : 550.341 *see Abstr.* 2601

534.843 2212

**Sound waves in rooms.** MORSE, P. M., AND BOLT, R. H. *Rev. Mod. Phys.*, 16, *pp.* 69–150, *April*, 1944.—A critical discourse on the present position of room acoustics, presented in 8 chapters. It begins with Sabine's pioneer work, gives an account of progress, and points out where further research is required. The general principles of wave acoustics are discussed and it is shown how they clarify and supplement the geometrical results of earlier workers. The importance of the reverberation time $T$, background noise, loudness of source and shape of room as they affect the recognizability of speech is examined. The value of $T$ given by Knudsen includes the absorptive effect of the air, for above 4 000 c/s this absorption may be several times the total absorption at the boundaries of the room. Methods of measuring room acoustics reveal the inadequacies of the geometrical theory. The general aspects of wave acoustics studied are the nature of the reaction between the sound wave and the walls of the room and the natures of the steady-state and transient response to a source of sound. The first of these involves a knowledge of the acoustic impedance of the surface; in the second and third the reverberant sound has the characteristic frequencies of the normal modes of vibration of the room and not necessarily the frequency of the source. In a simple rectangular room, a number of different decay rates exist; thus the decay curve cannot be a straight line, and rooms having smooth, regularly shaped walls show the greatest divergence of decay rates for different standing waves. In general, wave acoustics will have to be used for small regularly shaped rooms, and geometrical acoustics will be sufficient for the analysis of most large auditoriums. The report ends with a very full bibliography. G. E. A.

534.845 2213

**Sound insulation in buildings.** *Engineering*, 159, *p.* 12, *Jan.* 5, 1945.—An abstract of a publication by H.M. Stationery Office. The information provided is probably required by the average architect and builder, judging by the ineffective insulation of sound in modern houses. Noises may be externally or internally air-borne or structure-borne, the latter being probably the chief cause of complaint because of the continuity of modern structures. Suggested standards of quiet range from 15 phons for bedrooms to 60 phons for a noisy office. The article deals with the methods of reducing the different kinds of noises which occur inside buildings. G. E. A.

534.851 2214

**Notes on distortion in phonograph reproduction caused by needle wear.** BAUER, B. B. *J. Acoust. Soc. Amer.*, 16, *pp.* 246–253, *April*, 1945.—The point of the needle, usually spherical, develops flat spots at the points of contact with the groove. This gives rise to loss in h.f. output and to distortion. A tentative relation is formulated which might be used in determining the service life of needles in lateral disc reproduction. G. E. A.

535.14 2215

**Structure of the photon.** CHARLESBY, A. *Nature, Lond.*, 155, *pp.* 304–305, *March* 10, 1945.—Particles with negative mass may be assumed to exist. A particle of mass and charge both equal to that of the

electron but opposite in sign (called an *a*-tron), when coupled with an electron behaves in free space in a similar manner to a photon. If the two particles are separated by a suitable amount of energy a force of attraction arises which accelerates the electron towards the *a*-tron, and the latter away from the electron, the doublet then travelling forward with the velocity of light as limiting velocity. The Doppler effect and photo-electric effect are readily explained. The electromagnetic wave properties of the photon are paralleled by those of the probability waves of the doublet. In free space the doublet can be represented by a sinusoidal probability wave. The electric and magnetic fields associated with the photon arise from the magnetic moment due to electron (and *a*-tron) spin.

A. J. M.

535.212 : 621.384.4 : 576.858 : 582.951.4 2216

**The determination of virus infections in the potato tuber by the use of ultra-violet light.** McLEAN, J. G., AND KREUTZER, W. A. *Amer. Potato J.*, 21, *pp.* 131–136, *May*, 1944.—In the use of ultra-violet light for the determination of ring rot in potato seed tubers, numerous types of fluorescence were observed which differed in colour, location and intensity from the fluorescence caused by ring rot. Plants grown from such tubers showed a high percentage of leafroll and other virus diseases which suggest that the amount of virus infection might be reduced by an examination of cut tubers in ultra-violet light prior to planting, and discarding those showing fluorescence. The test is described. A G.E.C. 220 V a.c. H-4 mercury vapour lamp was used at 40°F. Results indicate that it is possible to identify with reasonable accuracy certain virus diseases on the basis of location, colour and intensity of the fluorescence. C. J. G.

535.215 : 537.525.8 2217

**Explanation of the Joshi effect.** PARSHAD, R. *Nature, Lond.*, 155, *pp.* 362–363, *March* 24, 1945.—[See Abstr. 2566 (1944)].

535.215 : 537.525.8 *see Abstr.* 2306

535.241.44 2218

**The confusion in brightness thinking.** SLAUER, R. G. *Illum. Engng, N.Y.*, 40, *pp.* 89–105, *Feb.*, 1945.—Discusses the importance of brightness in illuminating engineering, with particular reference to published work on the subject by Logan, Ainsworth and Luckiesh [Abstr. 1291 (1942), 1282 B (1944)]. In the discussion, these authors deal with certain aspects of the opinions attributed to them. J. W. T. W.

535.243 2219

**Illuminating and viewing conditions for spectrophotometry and colorimetry.** HARDY, A. C. *J. Opt. Soc. Amer.*, 35, *pp.* 289–292, *April*, 1945.—Gives reasons for the author's preference for normal illumination and diffuse reflection rather than the conditions recommended by the C.I.E., viz. 45° incidence and normal reflection. J. W. T. W.

535.243 2220

**Rapid photometric determination of silicon in low alloy and stainless steels.** ROZENTAL, D., AND CAMPBELL, H. C. *Industr. Engng Chem.* (*Analyt. Edit.*), 17, *pp.* 222–224, *April*, 1945.—The method, which uses water as a reference sample, is subject to interference from Cr only. Using precalibrated curves for various general types of steel, Si can be determined with an accuracy of ±0·04% Si without correcting for Cr, or ±0·02% when the correction is made. The deviation in the observed Si percentage is directly proportional to the Cr conc.

535.243 2221

**Extinction coefficients of spectrophotometric standards as determined with the Beckman spectrophotometer.** VANDENBELT, J. M., FORSYTH, J., AND GARRETT, A. *Industr. Engng Chem.* (*Analyt. Edit.*), 17, *pp.* 235–237, *April*, 1945.—The Beckman spectrophotometer was used to determine the extinction coefficients of several absorption standards, including anthraquinone and salicylaldehyde in EtOH. Optimum extinction coefficients were obtained with instrument densities of 0·5 to 1·9. The coefficients for $KNO_3$ in $H_2O$, $K_2CrO_4$ in 0·05 *N* KOH, and a vitamin A ester in EtOH, agree with values obtained with other types of spectrophotometric instruments.

535.243 2222

**Spectrophotometric determination of small amounts of copper using rubeanic acid.** CENTER, E. J., AND MACINTOSH, R. M. *Industr. Engng Chem.* (*Analyt. Edit.*), 17, *pp.* 239–240, *April*, 1945.—A rapid, accurate method for small amounts of Cu, using rubeanic acid, is described. Spectral transmittance curves for Cu, Ni, Co, and Fe in a weak acetic acid solution with rubeanic acid are shown. Fading of the colour and maximum permissible amounts of certain elements at 650 mμ are indicated. Transmittance/Cu-concentration curves were drawn for wavelengths of 400 and 650 mμ.

535.243 : 541.124/.128 2223

**A spectrophotometric study of the anhydro base of viridine green.** HILL, T. L., BRANCH, G. E. K., AND PATAPOFF, M. *J. Amer. Chem. Soc.*, 67, *pp.* 454–463, *March*, 1945.—The extinctions of rapidly fading solutions of a mixture of the anhydro base and the Me ether of viridine green in MeOH–$C_6H_6$ were determined at various wavelengths at noted times. The extinctions at any time were found graphically. From zero time extinction values the fraction of the anhydro base in the original mixture, the fraction converted to the ion in solution, and the molecular extinction coefficients were calculated. The spectra of the anhydro base in the MeOH–$C_6H_6$ mixture and in $C_6H_6$ alone were obtained and compared. MeOH produces a large shift of the absorption maximum toward the red end of the spectrum. The rates of change of extinctions at 6 400 and 5 000 Å in alkaline, neutral, and slightly acid solutions were measured. The rate of conversion of the anhydro base to the Me ether is the sum of two reaction rates, both first order with respect to the anhydro base, but one independent of the acid and alkali, and the other with respect to acid.

W. R. A.

535.243 : 541.132 2224

**Spectrophotometric studies on cerium (IV) sulphate complex ions.** MOORE, R. L., AND ANDERSON, R. C. *J. Amer. Chem. Soc.*, 67, *pp.* 167–171, *Feb.*, 1945.—Spectrophotometrically aq. $Ce(ClO_4)_4$ gives no evidence of the formation of any coloured complex ion and obeys Beer's Law at conc. $< 0{\cdot}01\ M$. In aq. $Ce(SO_4)_2$ ($< 0{\cdot}01\ M$) a complex ion containing one $Ce^{++++}$ and one $SO_4^{--}$ predominates.

Complex ions containing more than one $SO_4$= become appreciable at higher concentrations. An approximate value for the instability constant of the simplest complex ion is given. W. R. A.

535.243 : 545.81 2225

**Determination of gamma-tocopherol in vegetable oils.** FISHER, G. S. *Industr. Engng Chem.* (*Analyt. Edit.*), 17, *pp.* 224–227, *April*, 1945.

535.247.4 : 544 : 669.14 2226

**Application of colorimetry to the analysis of corrosion-resistant steels.** MILNER, O., PROCTOR, K. L., AND WEINBERG, S. *Industr. Engng Chem.* (*Analyt. Edit.*), 17, *pp.* 142–145, *March*, 1945.—A method using $H_2O_2$ for determining traces of Ti in corrosion-resistant steel was developed and adapted to the photo-electric colorimeter. Ti cannot be completely separated from large amounts of Fe, Cr, and Ni by the use of a single cupferron precipitation. A spectrophotometric study suggests that the effect of these interferences can best be overcome by a compensating blank reading. Mo and V are removed by the use of $Na_2O_2$. The procedure is given in detail and the validity of the method is established by the analysis of samples of known Ti content. N. M. B.

535.247.4 : 621.317.755 2227

**An oscillographic method for the photometry of photographic flash lamps.** PROJECTOR, T. H., AND BARBROW, L. E. *Rev. Sci. Instrum.*, 16, *pp.* 51–53, *March*, 1945.—The lamps are flashed in a 60 in. sphere equipped with vacuum photocell and correcting filter. The cell is connected in an oscilloscope circuit with an oscillator giving a broken line trace. For most lamps the time of sweep is about 100 millisecs., though for high speed lamps it may be less. A 1 500 W filament lamp is used as standard.

J. W. T. W.

535.31 2228

**Pictures and images.** SLEATOR, W. W. *Amer. J. Phys.*, 13, *pp.* 15–23, *Feb.*, 1945.—A discussion of image formation by plane mirrors, lenses and prisms, with special regard to inversion in 2 or 3 dimensions, movements of object and image, real images of virtual objects by double reflection and the prism binocular.

535.312 : 549.211 : 548.73 : 537.531
*see Abstr.* 2308–2310

535.317 2229

**Lens aberrations—a classroom demonstration.** JENSEN, A. S. *Amer. J. Phys.*, 13, *pp.* 113–115, *April*, 1945.

535.317 : 771.35 2230

**A photographic lens system.** GLANCY, A. E. *J. Opt. Soc. Amer.*, 35, *pp.* 307–308, *April*, 1945.—Describes a photographic lens system characterized by a wide aperture ratio attained by incorporating a very weak meniscus lens. A modified type of Cooke system is adopted and the zonal variation of the spherical aberration is markedly reduced as compared with earlier attempts. It is claimed that the great improvement in spherical aberration and sine condition are attained at no expense to colour and field curvatures and chromatic variation of the spherical aberration.

A. H.

535.317.1 = 4 2231

**Harmonic analysis of optical images.** DUFFIEUX, P. M. *Ann. Phys., Paris*, 14, *pp.* 302–338, *July–Dec.*, 1940. The discussion is concerned with those cases where the energy distribution in the image is a function of one variable only. Harmonic analysis leads to relationships between an extended object, its image, and a point object. Diffraction figures may be studied by means of an analysis of interference fringes. The algebraic expression of the object-image transform gives information on the resolving power of a system. The only assumption made is that quantities of energy may be added as scalars, i.e. that the source emits incoherent radiation. N. C.

535.317.318 2232

**The inverting eyepiece and its evolution.** TAYLOR, E. W. *J. Sci. Instrum.*, 22, *pp.* 43–48, *March*, 1945.—The evolution of the inverting eyepiece from a simple convex lens to the elaborate modern 7-component systems is traced. The conditions that an eyepiece should satisfy are stated with special reference to the "Petzval sum," the apparent field of view, the exit pupil and the eye clearance. Reference is also made to the use of aspherical refracting surfaces and to the simplification of design that may be expected to result from their use. Constructional details of various known types of eyepiece are given in the form of a table.

535.32 : 532.13 *see Abstr.* 2169

535.32 : 548.0 *see Abstr.* 2561

535.324 : 541.265 *see Abstr.* 2509

535.33 2233

**Colour spectrograms for demonstration purposes.** KRETSCHMER, H. H. *Amer. J. Phys.*, 13, *pp.* 111–112, *April*, 1945.

535.33–31 : 778 *see Abstr.* 2655

535.33.071 : 535.61–1 2234

**Small prism infra-red spectrometry.** BARNES, R. B., MCDONALD, R. S., VAN ZANDT WILLIAMS, AND KINNAIRD, R. F. *J. Appl. Phys.*, 16, *pp.* 77–86, *Feb.*, 1945.—A small all-purpose infra-red spectrometer is described in detail and the theoretical and experimental resolution obtainable is discussed. Some experimental data obtained with the instrument are presented, including the spectra of some common substances. The emission spectra of an H–3 Hg arc using various prism materials are shown, and also the absorption spectra of ammonia (at 3 330 cm.$^{-1}$), methane (at 3 020 cm.$^{-1}$), HCl (at 2 990 cm.$^{-1}$), $H_2O$ vapour (at 1 596 cm.$^{-1}$) and methyl alcohol vapour (from 900 to 400 cm.$^{-1}$). L. S. G.

535.336.2 : 539.155.2 2235

**Electronic problems involved in the practical application of the mass spectrometer.** HIPPLE, J. A., GROVE, D. J., AND HICKAM, W. M. *Rev. Sci. Instrum.*, 16, *pp.* 69–75, *April*, 1945. *See also Elect. Engng, N.Y.*, 64, *pp.* 141–145, *April*, 1945.

535.336.2 : 537.54 : 539.155.2 2236

**The mass spectrometer. A new electronic aid to analysis.** HART, E. D. *Electronic Engng*, 17, *pp.* 185–188, *Oct.*, 1944.—The mass spectrometer, developed from early work on positive rays, consists essentially of a high-vacuum tube in which gas to be analysed is at a pressure of about $10^{-4}$ mm. of Hg. Gas molecules are ionized by impact with an electron stream produced thermionically and the resultant positive ions are accelerated into a curved magnetic field arranged

so that only ions of a particular mass reach a collecting electrode and give up their charge to an electrometer. The electrometer reading can be interpreted quantitatively for ions of different masses and analysis thus effected. Applications of the instrument are mainly in analysis of small quantities of gases in presence of large quantities of others, more quickly and easily than by any other process. The Westinghouse commercial instrument is described in some detail and an elementary mathematical expression governing its functioning is derived. E. D. H.

535.338 : 537.228.5 *see Abstr.* 2296

535.338.3 2237

**Long duration of the Balmer spectrum in excited hydrogen.** JABLOŃSKI, A. *Nature, Lond.*, 155, *p.* 397, *March* 31, 1945.—[See Abstr. 2604 (1944)].

535.338.4 2238

**The band spectrum of bismuth monoxide, (BiO).** SEN GUPTA, A. K. *Indian J. Phys.*, 18, *pp.* 182–186, *June*, 1944.—A re-examination is made of the BiO spectrum given by the arc between Bi and C electrodes. The bands discussed lie in the region $\lambda$5 550–6 720 Å, and are apparently single-headed and all degrade to the red. The heads are arranged into a single system and the equation fitting the heads is given. A. H.

535.338.4 2239

**Rotational analysis of the $S_2$ band spectrum.** NAUDÉ, S. M. *Nature, Lond.*, 155, *pp.* 426–427, *April* 7, 1945.—The $S_2$ bands between $\lambda$4 400 and 4 950 Å have been photographed in the fourth order, and the bands between 4 950 and 6 200 Å in the third order of the 21 ft. Gale concave grating. The dispersion obtained amounted to 0·6 Å/mm. in the fourth and 0·8 Å/mm. in the third order. The positive column of an inverted $\Pi$-tube ("Pyrex" glass) fitted with large cylindrical electrodes was used as light source. The discharge was maintained in pure sulphur vapour by a 5 kVA, 220/12 000 V step-up transformer.

535.338.4 2240

**The dissociation energies of CO, $N_2$, NO and CN.** GAYDON, A. G., AND PENNEY, W. G. *Proc. Roy. Soc. A.*, 183, *pp.* 374–388, *June* 18, 1945.—A discussion is made of the Birge–Sponer method of extrapolating vibrational energy levels to the dissociation limit and of Hund's non-crossing rule [Abstr. 512 (1930)] that potential energy curves of the same electronic species never cross. An application is made in the discussion of the dissociation energies of CO, $CO^+$, $N_2$, $N_2^+$, NO and CN. By assuming that the intensity variations in the Fourth Positive bands of CO, usually regarded as due to a predissociation, are really perturbations, and by adopting an alternative interpretation to the commonly accepted one for the predissociation in the First Positive bands of $N_2$, it is possible to reconcile existing data with the non-crossing rule and the Birge–Sponer extrapolations only with the values $D(CO) = 11{\cdot}11$ eV, $D(N_2) = 9{\cdot}764$, $D(NO) = 6{\cdot}49$, $D(CN) = 7{\cdot}5$. The corresponding value of the latent heat of sublimation of C is 170·1 kcal./mole. The view is expressed that the non-crossing rule is a reliable guide in the correlation of atomic and molecular energy levels. L. S. G.

535.338.4–31 2241

**Ultra-violet band systems of the HgI molecule.** RAO, K. R., SASTRY, M. G., AND KRISHNAMURTY, V. G. *Curr. Sci.*, 14, *p.* 69, *March*, 1945.

535.338.42 2242

**Perturbed bands of beryllium oxide between $\lambda$8 000 Å and $\lambda$10 000 Å.** LAGERQVIST, A., AND WESTÖÖ, R. *Ark. Mat. Astr. Fys.*, 31*A*, *No.* 21, 14 *pp.*, 1945.—An extension of a previous study [Abstr. 4527 (1933)] of the infra-red system of bands, $\Pi$–$\Sigma$, to about $\lambda$10 000 Å. 2 of the bands known earlier—(2,0) and (3,1)—are extended and 4 new bands—(4,2), (1,0), (2,1) and (0,0)—are found. The origins of the (1,0) and (0,0) bands are at $\lambda$8 713·41 Å and $\lambda$9 647·52 Å respectively. Perturbations exist in several of the bands and these are explained by assuming that rotational terms in the vibrational levels 1, 2, 3 of the $\Pi$-state are perturbed by corresponding terms in the vibrational levels 8, 9, 10 of the $\Sigma$-state. L. S. G.

535.338.42 : 536.63 : 539.132 *see Abstr.* 2363

535.34 : 537.531 : 548.73 *see Abstr.* 2589

535.343 2243

**Absorption spectra of mercury halides.** GAYDON, A. G. *Nature, Lond.*, 155, *p.* 452, *April* 14, 1945.

535.343.4–31 2244

**The near ultraviolet absorption spectrum of aniline vapour.** GINSBURG, N., AND MATSEN, F. A. *J. Chem. Phys.*, 13, *pp.* 167–171, *May*, 1945.—The absorption spectrum of aniline vapour was photographed in the 1st and 2nd order of a 3-m grating spectrograph. The strongest bands appeared as doublets and on the basis of these, a tentative analysis was made and compared with the available Raman data.

535.345.1 : 551.463 2245

**A note on some laboratory measurements of the transparency of sea water.** YOUNG, R. T. *J. Mar. Res.*, 5, *pp.* 111–115, *May* 20, 1943.—The measurements were made on samples obtained down to 60 m depth in the Pacific Ocean. The construction and operation of the absorption apparatus is described. A parallel beam of light passed through a glass tube of diam. 2·5 cm and length 1 m, and on through an aperture of diam. 0·8 cm and was incident on an RCA 917 photocell. Two identical tubes were rigidly mounted in the parallel grooves of an optical bench fastened to a flat steel plate, which could be moved by a rack and pinion parallel to itself across a 10 in. channel beam to bring either of the tubes into the light beam. The ends of the tubes were ground perpendicular to the axes of the tubes to within 30″ and glass flats were pressed against the ends. Glass to glass contacts were sealed with stop-cock grease. The photocell current was amplified by a single stage amplifier using an RCA 954 pentode acorn tube in a circuit described by Gabus and Pool [Abstr. 3283 (1937)]. C. J. G.

535.361.2 2246

**On the problem of the diffuse reflection of light.** AMBARZUMIAN, B. *J. Phys., USSR*, 8, 2, *pp.* 65–75, 1944.—The light is scattered by a semi-infinite medium consisting of plane parallel layers bounded on one side by a plane $A$. A beam of parallel rays falls on $A$ and penetrates the medium undergoing absorption and diffusion. The angle formed by the direction of the rays with the internal normal is $\theta_0$, and $\phi_0$ is the azimuth of the incident rays. A function, $x(\cos\gamma)$, called the scattering indicatrix, gives the relative distribution of radiation scattered by a volume element from a direction $\theta$, $\phi$ in a direction $\theta'$, $\phi'$,

e scattering angle, $\gamma$, between the 2 directions being ven by

$$\cos\gamma = \cos\theta\cos\theta' + \sin\theta\sin\theta'\cos(\phi - \phi')$$

functional equation for the reflection function $\theta, \phi; \theta_0, \phi_0)$, which is related to the intensity of the ffuse radiation, is set up and solved when the attering indicatrix is expressed by means of Legendre lynomials,

$$x(\cos\gamma) = \sum_{i=0}^{n} x_i P_i(\cos\gamma)$$

pecial cases considered are the spherical and the ongated indicatrix, for which $x(\cos\gamma) = 1$ and $\cos\gamma) = 1 + x_1\cos\gamma$ respectively. Some con- uding remarks are made concerning limitations in ie applicability of Lambert's Law. L. S. G.

5.371 2247

**Recent studies on the fluorescence of glass.** KREIDL, . J. *J. Opt. Soc. Amer.*, 35, *pp.* 249–257, *April*, 945.—Discusses the use of fluorescent glasses, uorescence centres, the constitution of glass, relation etween fluorescence and constitution, manganese lasses and the identification of optical glasses. A. H.

35.371 : 535.66 2248

**A method for determining the chromaticity of uorescent material.** BYLER, W. H., AND CARROLL, . C. *J. Opt. Soc. Amer.*, 35, *pp.* 258–260, *April*, 945.—The chromaticity of fluorescent materials is etermined by means of a method based on the rocedure for calibrating the Tri-X panchromatic lm, the spectral energy distribution being determined pectrographically. A. H.

35.372 2249

**The fluorescence of diethyl pseudo-isocyanine hloride in solution.** HUTTEN, E. H., AND PRINGSHEIM, . *J. Chem. Phys.*, 13, *pp.* 121–127, *March*, 1945.— The fluorescence and absorption spectra of the dye iethyl pseudo-isocyanine chloride in various solid olutions and at several concentrations and tem- eratures were obtained by a spectrograph of high ispersion. The dye is fluorescent not only in the olymerized state but also when it is embedded in a rigid" medium.

35.372 2250

**On the fluorescence spectra of naphthacene in solid olution of anthracene for different exciting wavelengths.** GANGULY, S. C. *J. Chem. Phys.*, 13, *pp.* 128–130, *March*, 1945.—The fluorescence of green anthracene rystal (naphthacene in solid solution of anthracene) was studied with exciting light of different wave- engths and the long-wavelength limit for excitation as found. From the study of the fluorescence and bsorption spectra, an attempt is made to interpret he mechanism of the fluorescence phenomenon in this rystal.

535.375.5 : 553.621 2251

**Raman spectrum of quartz.** KRISHNAN, R. S. *Nature, Lond.*, 155, *p.* 452, *April* 14, 1945.

535.375.51 2252

**A method for obtaining depolarization factors of Raman lines, with results for carbon tetrachloride and toluene.** CLEVELAND, F. F. *J. Chem. Phys.*, 13, *pp.* 101–106, *March*, 1945.—A method for obtaining depolarization factors of Raman lines is described in which a 90° split-field Polaroid disc is placed in contact with the window of the Raman tube and is focused upon the slit of the spectrograph by means of a condensing lens. Corrections for real or apparent polarization owing to the spectrograph, reciprocity failure of the plates and convergence errors, are made. The precision of the results was tested by measurements on 5 different spectrograms of $CCl_4$. Intensities were obtained by use of a Gaertner microdensitometer. Depolarization factors for toluene were also obtained. A reasonable working rule is to regard those Raman lines having observed depolarization factors $\geqslant 0{\cdot}78$ as depolarized, all others as polarized.

535.375.51 2253

**The intensity and polarization of Raman lines.** EDGELL, W. F. *J. Chem. Phys.*, 13, *p.* 132, *March*, 1945.—In an attempt to calculate the intensity and depolarization factor, the elements of the polarizability tensor are expanded in terms of internal instead of normal co-ordinates, and the set of constants obtained characterize the intensity in the same way as force constants characterize frequency of vibration. An equation generalizing the bond polarizability method is obtained and simplified. An alternative method is also considered. N. M. B.

535.375.51 2254

**Intensity and polarization of Raman lines and the form of molecular vibrations.** EDGELL, W. F. *J. Chem. Phys.*, 13, *p.* 133, *March*, 1945.—A critical examination of reported assumptions that the polarizabilities of individual bonds are functions of the bond distance only and independent of changes in the valence angles, and of the conclusion from this that Raman lines due to pure deformation vibrations have, irrespective of their symmetry, a depolarization factor of 6/7. Arguments showing the uncertainty of these views are discussed. N. M. B.

535.391 2255

**Thickness control of sharp cut-off type of glasses.** GAGE, H. P. *J. Opt. Soc. Amer.*, 35, *pp.* 276–282, *April*, 1945.—A mathematical analysis of the shape of certain spectrophotometric curves, especially those of the sharp cut-off type of coloured glass. A. H.

535.417 : 620.179.6 2256

**Optical surface-finish meter.** *Engineering*, 160, *p.* 26, *July* 13, 1945.

535.42 : 537.533.73 : 061.22 : 537.531 *see Abstr.* 2311

535.43 : 537.29 *see Abstr.* 2299

535.43 : 548.0 *see Abstr.* 2562

535.435 : 541.24 *see Abstr.* 2507

535.6 : 621.383.2 2257

**The colour response of photoelectric cells.** SOMMER, A. *J. Televis. Soc.*, 4, *pp.* 51–57, *Sept.*, 1944.—[Abstr. 2136 B (1945)].

535.61–1 : 535.33.071 *see Abstr.* 2234

535.65 2258

**Design of a printed spectrum.** MACADAM, D. L. *J. Opt. Soc. Amer.*, 35, *pp.* 293–296, *April*, 1945.—Describes the processes used for the reproduction of the colour charts illustrating different spectra and the chromaticity diagram in the 3.7.1944 issue of *Life*. The chromaticity diagram is reprinted in the present paper. J. W. T. W.

535.653.85 2259

**Munsell standard colours specified for four illuminants.** NICKERSON, D. *Illum. Engng, N.Y.*, 40, *pp.* 159–171, *March*, 1945.

535.66 : 535.371 *see Abstr.* 2248

535.662 2260

**Colour of soils.** NICKERSON, D., KELLY, K. L., AND STULTZ, K. F. *J. Opt. Soc. Amer.*, 35, *pp.* 297–300, *April*, 1945.—Gives results of colorimetric measurements and the spectral reflectance curves for a number of soils, both within and outside U.S.A. Some data are also given for foliage and grass samples.

J. W. T. W.

535.668.1 : 535.843 : 537.533.72 2261

**Light and electron microscopy of pigments.** BRUBAKER, D. G. *Industr. Engng Chem.* (*Analyt. Edit.*), 17, *pp.* 184–187, *March*, 1945.—The electron microscope is found to yield a more accurate picture of the size and shape of the particles in pigments, particularly of the small-sized ones, than does the light microscope. Comparison micrographs of small-particle ZnO are included together with pairs of light and electron micrographs of identical fields of 3 different kinds of ZnO. These electron micrographs reveal that particle shapes, which appear spherical in light micrographs, depart considerably from the spherical, and this will need to be taken into account in any accurate evaluation of particle size by microscopical observation. Further, smaller particles and relatively more small particles appear in electron than in the light micrographs of many pigments, especially in those of small average size. H. H. HO.

535.683.1 : 676.3 *see Abstr.* 2649

535.7 : 612.84 2262

**The testing of night vision.** GODDING, E. W. *Trans. Illum. Engng Soc., Lond.*, 10, *pp.* 27–41, *Feb.*, 1945.—Discusses the mechanism of dark adaptation and the causes of abnormality in night vision and points out the many factors which require close control in testing dark adaptation. A suggested standard test and testing technique is described and the relative advantages of tracing full curves or of determining final thresholds only are enumerated. J. W. T. W.

535.7 : 613.6 2263

**Vision and industrial production.** TIFFIN, J. *Illum. Engng, N.Y.*, 40, *pp.* 239–257, *April*, 1945.—Describes tests of various visual characteristics of a large number of industrial employees and shows how certain characteristics, correlated with efficiency in carrying out any given process, can, if suitably chosen, be used to indicate suitability for a given type of work, the need for visual correction and, to a certain extent, accident-proneness. J. W. T. W.

535.7 : 628.9 2264

**Visual effect of non-uniform surrounds.** MOON, P., AND SPENCER, D. E. *J. Opt. Soc. Amer.*, 35, *pp.* 233–248, *March*, 1945.—In continuation of a previous paper [Abstr. 933 (1945)] the authors summarize the existing data on the effect of brightness of surrounds (including glare sources) on the contrast sensitivity of the eye. They conclude that for ease and comfort of seeing, the equivalent adaptation brightness of the brightest part of the visual field should not exceed 3 times that for the work; for the darkest part it should not be less than $1/3$ that for the work, though this is less important. The photochemical theory of vision is used to derive a criterion for the avoidance of the unpleasant sensation (as distinct from loss of visual efficiency) due to transient glare conditions.

J. W. T. W.

535.733.1 : 612.84 2265

**Colour vision of the fovea centralis.** STILES, W. S., THOMSON, L. C., AND PIRENNE, M. H. *Nature, Lond.*, 155, *pp.* 177–178, *Feb.* 10, 1945.—[See Abstr. 2428 (1944)].

535.81 : 771.35 2266

**A lens for a miniature camera.** CORNOG, I. C. *Amer. J. Phys.*, 13, *pp.* 41–43, *Feb.*, 1945.—Describes a method of using an old type of photographic objective (the "Rapid Rectilinear") with a Leica to give the equivalent of a lens of focal length 5 or 6 in.

A. H

535.824 2267

**Resolving power of the microscope using polarized light.** HOPKINS, H. H. *Nature, Lond.*, 155, *p.* 275 *March* 3, 1945.—[See Abstr. 1049 (1943)].

535.825 2268

**A chin-operated focus adjustment for the dissecting microscope.** HEGRE, E. S., AND BLOUNT, R. F. *Science*, 101, *pp.* 126–127, *Feb.* 2, 1945.

535.843 : 537.533.72 : 535.668.1 *see Abstr.* 2261

535.87 : 681.4 2269

**The deposition of lead-sulphide mirrors on glass.** SMETHURST, P. C. *J. Sci. Instrum.*, 22, *pp.* 52–54 *March*, 1945.—Processes are described in detail whereby satisfactory permanence of the deposited mirrors is obtained by a modification of the normal process, the deposition being made on a layer of metallic hydroxide (most suitably of Cu or Pb) which has been adsorbed on the glass. In the case of $Cu(OH)_2$, insoluble in alkali, a separate solution is used to produce the adsorbed layer; in the case of $Pb(OH)_2$ the stock solutions for deposition are applied in such a way that the hydroxide layer is formed just before deposition takes place; precautions to avoid redissolution of the hydroxide (soluble in alkali) are given. N. M. I

536.2 : 538.54 = 4 *see Abstr.* 2359.

536.2.01 : 537.226 : 621.315.21.029.5 : 530.19 *see Abstr.* 2146

536.21 227

**On the problem of heat conduction in thin plates.** LOWAN, A. N. *J. Math. Phys.*, 24, *pp.* 22–29, *Feb* 1945.—The differential equation governing the flo of heat in a thin plate is solved in the following cases. I. Circular plate of radius $R$. Initial temperature $f(r)$ Boundary temperature $\phi(t)$. II. Circular plate initial at temperature $f(r)$; edge impervious to heat. III. Pla of infinite or semi-infinite extent. IV. Plate bounde by $x = 0$ and $y = 0$. Initial temperature $f(x, y)$ boundary $x = 0$ kept at temperature $\phi_1(y, t)$; bounda $y = 0$ kept at temperature $\phi_2(x, t)$. In the solution these problems the appropriate Green's function used together with the Laplace transform. L. S.

536.25 = 4 22

**Generalization of the theory of calorific convectio The concept of active convection. Technical cons quences. I.** ROCARD, Y., AND VERON, M. *J. Phy*

*dium*, 4, *pp.* 81–95, *May*, 1943.—Two types of nvection are distinguished: inactive convection, ich is the classical form where the heating or oling fluid is thermodynamically passive, and active nvection, where the fluid takes part in the creation the heat which it conveys (e.g. a flame, a reaction, :). The general equation giving the distribution of nperature in the fluid is set up, and the distribution d the coefficient of convection are found in the se of the 2 types of convection mentioned. A good al of mathematical analysis is involved. L. S. G.

6.411 : 533.21 : 536.71 *see Abstr.* 2285

6.42 2272

**The vapour pressures of *cis*- and *trans*-decahydrophthalene.** Seyer, W. F., and Mann, C. W. *Amer. Chem. Soc.*, 67, *pp.* 328–329, *Feb.*, 1945.—the range −30° to 223° the vapour pressures are presentable by the equations for $\log_e p$:—*cis* $-1\,702{\cdot}20/T + 6{\cdot}8139\log_e T - 34{\cdot}32$; *trans* $-2\,182{\cdot}38/T + 6{\cdot}8509\log_e T - 32{\cdot}64$. Critical nperatures are: *cis*, 417·5°, *trans*, 398·2°. Molal ent heats and Trouton constants were evaluated.

W. R. A.

6.42 : 551.574 2273

**Sublimation in a Wilson chamber.** Cwilong, B. M. *ature, Lond.*, 155, *pp.* 361–362, *March* 24, 1945.—epeating Wilson's condensation experiments at low nperature, it was found that, for clean air, above 35°C. only liquid droplets and below −35°C. ice ystals, are formed; below −80°C. the number of rticles decreases and grains of hail appear. Below 120° no particles are formed. These temperatures e affected by impurities. Sublimation phenomena ie to adiabatic cooling differ from condensation nenomena.

6.421.1 : 665.41 2274

**Melting point of paraffin wax. TAPPI Tentative tandard T630 m-45.** *Paper Tr. J.*, 120, *TAPPI Sect.*, . 133–134, *April* 5, 1945.—The standard A.S.T.M. ethod (D87-42) is described and recommended. he value reported is the temp. (to within 0·1°F.) which melted paraffin wax, when allowed to cool nder prescribed conditions, first shows a min. rate f temp. change. J. G.

6.46 2275

**Non-luminous flame gases.** David, W. T., Mann, , Mobbs, F. R., and Payman, W. *Nature, Lond.*, 55, *p.* 273, *March* 3, *and p.* 672, *June* 2, 1945.

6.46 2276

**The cool-flame and two-stage ignition systems in ther-air mixtures at room temperature.** Spence, K., ND Townend, D. T. A. *Nature, Lond.*, 155, *pp.* 330–31, *March* 17, 1945.—[See Abstr. 1216 (1940)].

6.49 : 621.317.7.088.7 2277

**Temperature compensation in indicating and recording nstruments.** Tagg, G. F. *J. Instn Elect. Engrs*, 92, *art II, pp.* 334–341, *Aug.*, 1945.—[Abstr. 2044 B 1945)].

6.511 2278

**A note on constant-pressure air thermometer.** ELKAR, V. N. *J. Univ. Bombay*, 13, *pp.* 27–29, *March*, 1945.

6.531 : 625.28 : 621.333.017.71 2279

**Measurements of railway motor temperatures in ervice.** Teker, J. W. *Trans. Amer. Inst. Elect. Engrs*, 4, *pp.* 545–550, *July*, 1945.—[Abstr. 2073 B (1945)].

536.581 2280

**Thermostat.** *Industr. Equipm. News*, 12, *p.* 47, *April*, 1944. *Abstr. in Biol. Abstr.*, 18, 15633, *Oct.*, 1944.—A bi-metal helix actuates a single-pole double-throw contact to make or break a circuit on temp. rise. It is adjustable for a temp. of 500 to 1 000°F. and is also graduated in corresp. degrees C. Sensitivity is within 0·5 deg. C. Contacts are rated to 300 W a.c., 150 W d.c. Two or three-wire connection can be made. C. J. G.

536.63 : 535.338.42 : 539.132 *see Abstr.* 2363

536.65 : 536.75 2281

**Trans-2-butene. The heat capacity, heats of fusion and vaporization, and vapour pressure. The entropy and barrier to internal rotation.** Guttman, L., and Pitzer, K. S. *J. Amer. Chem. Soc.*, 67, *pp.* 324–327, *Feb.*, 1945.—Values of $C_p$ have been determined calorimetrically from 14·56° to 271°K. The vapour pressure from 201° to 274° conforms to the equation

$$\log_{10} p(\text{cm.}) = -1\,757{\cdot}283/T - 0{\cdot}0171296T + 1{\cdot}88411\times10^{-5}T^2 + 11{\cdot}57265,$$

and the derived boiling point is 274·04°K. The following data were also obtained: m.p. 167·61 ±0·05 deg.K.; heats of fusion and vaporization 2 331·9 ±2 and 5 439 ± 15 g.-cal. per mol.; entropy of ideal gas at b.p. 69·12 ± 0·3 g.-cal. per degree per mol. The calorimetric entropy leads to a potential barrier of 1 960 g.-cal. per mol. restricting the rotation of each Me group. W. R. A.

536.66 2282

**Heats of formation of $Al_2(SO_4)_3 . 6H_2O$, $Al_2(SO_4)_3$, $KAl(SO_4)_2 . 12H_2O$, and $KAl(SO_4)_2$.** Young, F. E. *J. Amer. Chem. Soc.*, 67, *pp.* 257–261, *Feb.*, 1945.—Heats of solution of $Al_2(SO_4)_3 . 6H_2O$, $K_2SO_4$, and $KAl(SO_4)_2 . 12H_2O$ in $HCl . 12{\cdot}68H_2O$ and of $Al_2(SO_4)_3$, $Al_2(SO_4)_3 . 6H_2O$, $K_2SO_4$, and $KAl(SO_4)_2$ in $KOH . 277{\cdot}3H_2O$ have been measured. Computed heats of formation are:—$Al_2(SO_4)_3$, −820 990 ± 430; $Al_2(SO_4)_3 . 6H_2O$, −1 268 150 ± 360; $KAl(SO_4)_2$, −589 170 ± 310; $KAl(SO_4)_2 . 12H_2O$, −1 447 700 ± 260 g.cal. per mole. W. R. A.

536.66 : 541.57 : 541.127 *see Abstr.* 2460

536.7 : 541.123.2 2283

**The volume of mixing and the thermodynamic functions of binary mixtures. II. Benzene-cyclohexane.** Wood, S. E., and Austin, A. E. *J. Amer. Chem. Soc.*, 67, *pp.* 480–483, *March*, 1945.—The volume change on mixing $C_6H_6$ and cyclohexane at const. pressure was determined over the entire composition range from 15°C. to 75°C. From these data the excess change of the work content, energy and entropy on mixing at const. vol. over that of an ideal solution was calculated. The volume of mixing is positive and, in general, increases with temperature. The excess entropy on mixing at const. vol. is also positive over this temperature range. [See Abstr. 197 (1944)].

W. R. A.

536.7 = 3 2284

**On the thermodynamics of irreversible processes in gases with chemically reacting, dissociating and excitable components.** Meixner, J. *Ann. Phys., Lpz.*, 43, 4, *pp.* 244–270, 1943.—Basic equations are given which describe the complete dynamical behaviour of gases, including the irreversible processes of heat conduction,

internal friction, diffusion, chemical reactions and excitation. Onsager's reciprocity relationships [Abstr. 1674 (1932)] are discussed and also their transformation properties. The basic equations are used to determine all reversible motions of ideal gases [Abstr. 352 (1943)] whose components react with one another or are excitable. Various definitions of thermodynamical equilibrium are given and there is a discussion of stationary equilibrium. Equations are given describing the thermal diffusion effect and an inequality is deduced for the thermal diffusion factor.

L. S. G.

536.71 : 536.411 : 533.21 2285

**The thermal expansion and compressibility of a three-dimensional system of harmonic oscillators.** MATSEN, F. A., AND WALKEY, J. E. *J. Chem. Phys.*, 13, *pp.* 135–141, *April*, 1945.—Thermal expansions and compressibilities are calculated from equations of state of the Grüneisen form which are derived from a general partition function. The non-thermal energy and frequency are obtained as functions of volume, the constants in these functions being evaluated from data on the second virial coefficients of gases. Data of state are calculated for three types of thermal energy distributions, the classical, the Einstein, and the Debye. A limitation on the harmonic oscillator approximation is discussed as is the quantal effect in the law of corresponding states.

536.75 : 536.65 *see Abstr.* 2281

536.753 2286

**Entropy of saturated liquid-vapour mixtures, and Trouton's rule.** SILVER, R. S. *Nature, Lond.*, 155, *pp.* 274–275, *March* 3, 1945.

536.76 : 548.0 *see Abstr.* 2563

536.77 : 531.19 : 548.7 *see Abstr.* 2575

536.77 : 532.73 2287

**The thermodynamics of high-polymer solutions. I. The free energy of mixing of solvents and polymers of heterogeneous distribution.** SCOTT, R. L., AND MAGAT, M. **II. The solubility and fractionation of a polymer of heterogeneous distribution.** SCOTT, R. L. *J. Chem. Phys.*, 13, *pp.* 172–187, *May*, 1945.—The theories of Flory and Huggins for the free energy of mixing of a homogeneous chain polymer of uniform molecular weight with a single uniform solvent have been extended to the case of a polymer mixture of varying chain lengths with a mixture of solvents. By making assumptions similar to those of Huggins, and utilizing familiar statistical mechanical methods, the partial molal free energy of mixing of the solvent is $\bar{\Delta F}_0 = RT[\log_e \phi_0 + (1-\phi_0)(1-1/\bar{m}_N) + \mu(1-\phi_0)^2]$, where $\phi_0$ is the volume fraction of solvent, $\bar{m}_N$ a simple function of the number average mol. wt., and $\mu$ a constant characteristic of the polymer-solvent mixture (consisting largely of a heat term, but also including $\gamma$, the co-ordination number of the rubber segments). By assuming that a mixture of two solvents behaves like a new homogeneous liquid a method of calculating $\mu$ for such mixtures is developed. The free energy relations are applied to problems of solubility and fractionation. Critical conditions for solubility are obtained. A rigorous expression for the solubility is derived, although certain approximations are made to facilitate calculation, and to permit extension to polymers which are part "gel." Following the same methods the thermodynamic equilibria involved in fractionation are described by mathematical expressions which permit a comparison of the extraction and precipitation methods. The effectiveness of fractionation is shown to be dependent upon concentration.

536.77 : 532.77 : 532.612 *see Abstr.* 2181

536.8 : 621.56/.57 2288

**A novel form of refrigeration.** ROEBUCK, J. R. *J. Appl. Phys.*, 16, *pp.* 285–295, *May*, 1945.—[Abstr. 2245 B (1945)].

537.12 : 539.155.4 2289

**The 1944 values of certain atomic constants with particular reference to the electronic charge.** BIRGE, R. T. *Amer. J. Phys.*, 13, *pp.* 63–73, *April*, 1945.—A critical discussion of the errors in various determinations of the electronic charge by the oil-drop method of the faraday, and of Avogadro's number is given. It is considered that the most accurate method of determining the electronic charge is by means of the ratio of the faraday to Avogadro's number. The final values accepted for these constants are: electronic charge, $(4{\cdot}8021 \pm 0{\cdot}0006) \times 10^{-10}$ abs. e.s.u.; the faraday, 96 487·7 ± 10 abs. coulombs; Avogadro's number, $(6{\cdot}02338 \pm 0{\cdot}00043) \times 10^{23}$ per gm. mol.

A. J. M.

537.122 : 531.66 2290

**Analysis of excitation functions.** OLDENBERG, O. *J. Chem. Phys.*, 13, *pp.* 196–198, *May*, 1945.—The mechanical laws of electron impact lead to the conclusion that, in any transfer of kinetic energy into quantized energy (excitation, dissociation), the "excitation function" should, at the threshold, start from zero and increase with increasing kinetic energy. This shape of the function is likely to cause a systematic error in the measurement of critical energies with certain non-equilibrium methods.

537.122 : 537.533.7 = 4 2291

**On the penetration of electrons in matter.** MONTEUX, Y. *Symposium on Cosmic Rays. Acad. Brasileira Ciênc., pp.* 147–150, 1943.—Using a formula due to Bloch [Abstr. 2606 (1943)] the range is calculated as a function of the energy. The values of the range are compared with various experimental values and the agreement is within about 10%.

L. S.

537.213 : 621.317.32 = 3 2292

**A method for determining the potential of a uniform double layer.** SCHWARZER, H. *Arch. Elektrotech.*, 37, *pp.* 505–508, *Oct.* 31, 1943.—The potential, $V$, is determined for the case when the double layer has a plane boundary. $V$ is proportional to the solid angle subtended by the boundary at the reference point and to the electric moment of the double layer. Apparatus is suggested for measuring the potential by replacing the double layer by a photo-electric surface and irradiating it from the point of reference.

R.

537.222.1 2293

**On the distribution of electricity on thin unclosed conducting layers.** GRÜNBERG, G. A. *J. Phys. USSR*, 7, 3, *pp.* 93–98, 1943.—The exact distribution is known only for a limited number of shapes (e.g. cylindrical, spherical or ellipsoidal). A new method is now given for determining the distribution in

ses (i) of a plane lamina, of any shape, placed in an ternal field, and (ii) an arbitrary portion of a thin herical shell. Similar results may be obtained for cylindrical lamina, placed in a two-dimensional ld. It is noted that in the general case of an bitrary thin shell in an arbitrary external field the act distribution of charge is given by the solution a certain integral equation. L. S. G.

7.226 : 536.2.01 : 621.315.21.029.5 : 530.19
*see Abstr.* 2146

7.226.1.08 : 621.396.616 : 621.317.333.029.6 2294
**A resonant-cavity method for measuring dielectric operties at ultra-high frequencies.** WORKS, C. N., AKIN, T. W., AND BOGGS, F. W. *Proc. Inst. Radio ngrs, N.Y.*, 33, *pp.* 245–254, *April*, 1945. *Trans. ner. Inst. Elect. Engrs*, 33, *pp.* 245–254, *April*, 1945.—bstr. 2026 B (1945)].

7.226.2 : 541.182.025 *see Abstr.* 2498

7.226.2 = 3 2295
**Frictional dispersion of the permittivities of organic uids in relation to the wavelength.** MEHLER, P. *nn. Phys., Lpz.*, 43, 4, *pp.* 225–243, 1943.—The ermittivities are measured by a resonance method at ie wavelengths 15 m., 60 m. and 109 m. The apparaus and method of measurement and calibration are lly described, and the measurements are made at rious temperatures between 8°C. and 50°C. The olar substances investigated are nitrobenzol, α-itronaphthalene and nitromethane, these forming a lute solution in the highly viscous Shell oil "K 20." he results are shown in a series of graphs, including ie dispersion curves, and there is a comparison with ie work of earlier authors [Abstr. 834, 4654 (1938), 352 (1939)]. L. S. G.

37.228.3 : 541.18 *see Abstr.* 2493

37.228.5 : 535.338 2296
**The Stark effect of certain multiplets.** MINNHAGEN, . *Thesis Phys. Inst., Univ. Lund.*, 81 *pp.*, 1944.—he field displacements of certain Ca and Ba lines for eld strengths up to 135 kV/cm. for Ca, and 120 kV/cm. or Ba were determined using a Stark-effect tube with hollow cathode as a source of ions. The filling gas ontained A, and some A I and A II lines were vestigated at a maximum field strength of 145 kV/cm. he light emission from different parts of the light ource was examined. The theory for the Stark ffect in Russell–Saunders' multiplets at low fields as discussed and applied to the perturbations etween the Ba I levels $7p^3P_{2,1,0}$ and $6d^3D_{3,2,1}$. he relative displacements were calculated assuming hat the radial parts of the matrix elements connecting he different $^3P$ levels with the different $^3D$ levels are qual. Theory gives a splitting of the $^3D$ term in 9 tark effect states, of which 8 were experimentally eparated. There is satisfactory agreement between xperiment and theory as regards relative shifts. A. J. M.

37.228.5 : 523.872 : 539.153.4 2297
**The interaction of a proton and a hydrogen atom in ts excited states.** KROGDAHL, M. K. *Astrophys. J.*, 00, *pp.* 311–332, *Nov.*, 1944.—The perturbation by proton of a hydrogen atom to which the electron emains bound in various excited states is considered by calculating the van der Waals forces involved. The interaction energy depends on $R^{-2}$ where $R$ is the nuclear separation, large compared with the radius of the perturbed atom; it is therefore large compared with cases where the perturbing field is due to another H atom. It may be evaluated exactly to any desired order of perturbation. Numerical values of the interaction are tabulated up to quantum state $n = 5$. The application to collision broadening of H absorption lines in stellar spectra is briefly indicated. A. HU.

537.228.5 : 523.872 : 539.153.4 2298
**The interaction of a proton and a helium atom in its excited states.** KROGDAHL, M. K. *Astrophys. J.*, 100, *pp.* 333–342, *Nov.*, 1944.—The perturbation of a He atom in various excited states by the field of a neighbouring proton is calculated and compared with that due to a homogeneous field. In the atmospheres of early-type stars the densities are such that the non-homogeneity of the field introduces significant differences from the simpler case. The results of the calculation are used to calculate the displacements of several triplet He lines of astrophysical interest, special attention being given to the line 4 470 Å, which is not shifted in stellar spectra though homogeneous fields shift it appreciably. A. HU.

537.29 : 535.43 2299
**The effect of electric field on the depolarization of light scattering in colloidal systems.** RAO, M. R. A. N. *Curr. Sci.*, 14, *pp.* 43–44, *Feb.*, 1945.—The effect of an electric field on the depolarization of the Tyndall scattering in graphite sols has been investigated using an incident beam (1) unpolarized, (2) polarized with vibrations perpendicular to the plane containing incident and scattered beams, (3) polarized with vibrations parallel to this plane. The degree of depolarization has been measured with the electric field (1) perpendicular to the incident beam and the direction of observation, (2) parallel to the direction of observation, (3) parallel to the direction of the incident beam. The degree of depolarization depends on the direction of the electric field, the potential gradient of the applied field, and the nature of the incident vibrations. Both direct and alternating fields give the same value for the depolarization. The electric field does not affect the polarization in the case of bentonite sols, but there is a considerable effect with graphite sols. A. J. M.

537.311 : 541.132 : 532.74 2300
**The electrical conductivity of thallous chloride solutions of ethylene glycol-water.** GARRETT, A. B., AND VELLENGA, S. J. *J. Amer. Chem. Soc.*, 67, *pp.* 225–228, *Feb.*, 1945.—The equivalent conductances of various concentrations of TlCl in $H_2O$ (20%, 40%, 60% and 80%) in aq. ethylene glycol, and in ethylene glycol were determined, and the dissociation constants of the TlCl in the various solvents calculated. An increase in the thermodynamic dissociation constant with concentration was attributed to associations to triple ion formation, or to sorting of the solvent molecules. W. R. A.

537.311.37 : 551.510.535 : 523.74 2301
**The electrical conductivity of an ionized gas in a magnetic field, with applications to the solar atmosphere and the ionosphere.** COWLING, T. G. *Proc. Roy. Soc. A*, 183, *pp.* 453–479, *June* 18, 1945.—A com-

parison is made between the formulae for the conductivity given by the free-path method and the more exact velocity-distribution method of Chapman and Enskog. The formulae are identical in form if a correction is applied to the free path method; but the latter, when uncorrected, gives correct results for the electron contribution to the conductivity in practical cases and for the ion contribution if a large number of neutral molecules are present. A gas with several constituents is considered and the ternary mixture is discussed in detail. An application is made to the conductivity in the sun's outer layers and in the earth's upper atmosphere. The magnetic fields of sunspots produce marked changes in the conductivity, and mechanical forces due to currents induced in moving material are very important in the sun and in the F-layer of the earth's atmosphere. The solar results are used to discuss the motion of solar prominences and eruptions. In the earth's atmosphere, the observed collision frequencies of electrons imply upper limits for ion-densities in the E and F layers. The integral conductivities of the E and F layers are estimated and it is shown that tidal oscillations in these layers must be between 100 and 1 000 times as great as those at the ground. Diamagnetism and drift currents make negligible contributions to the lunar and solar variations of the earth's magnetic field. L. S. G.

537.312.5 : 537.525.8 *see Abstr.* 2307

537.362 : 541.182.6 *see Abstr.* 2500

537.39 : 591.181 *see Abstr.* 2637

537.523.4 : 621.3.015.533 2302

**Recording electric discharge paths in air-gaps.** BANNER, E. H. W. *Engineering*, 159, *pp.* 383–385 *and* 390, *May* 18, 1945.—A method of recording discharge paths by direct electrical action on photographic film is described. This is complementary to klydonography, using, in this work, film with its plane along an axis of the discharge, not normal to it. The discharge paths for various standard spark-gaps are shown and the conditions for true relative results discussed, including the effects of the semi-conducting film in the air-gap. Expressions for voltage gradient and notes on the technique are given. An application to one feature of the design of thermionic vacuum devices is quoted. E. H. W. B.

537.525 2303

**Disintegration of the plasma of a low-pressure electrical discharge.** GRANOVSKY, V. L. *J. Phys., USSR*, 8, 2, *pp.* 76–88, 1944.—The disintegration is involved in the process of de-ionization of the gas which occurs after the self-sustained discharge has ceased. The theory of the disintegration, in the absence of an electric field, is deduced from the general theory of the transient state of the plasma [Abstr. 1355 (1944)]. Gradual temperature drop of electrons results in a rapid discontinuation of collisions of the first kind and in a slow decrease in the ambipolar diffusion coefficient. The law of de-ionization is not exponential, in general, and conditions are found under which the deviation becomes appreciable. The effect of excited atoms on the de-ionization is considered. Experiments carried out on the de-ionization of Hg vapour in cylindrical tubes of 65 and 105 mm. dia., within a pressure range of 2·3 to 6·5 $\mu$ Hg, reveal quantitative agreement with the theory. Conditions are established where the space recombination begins to play an appreciable rôle in the deionization process. L. S. G.

537.525.8 2304

**The preferential incidence of the light-effect in the high-frequency region of the discharge current.** JOSHI, S. S. *Curr. Sci.*, 14, *pp.* 67–68, *March*, 1945. [*See Abstr.* 2306, 2307 (1945)].—The apparent variation of the light-effect $\Delta i$, with the mode of the measurement of the discharge current $i$, was noticed soon after the discovery of the phenomena. Thus, when $i$ was observed with some soft diodes, $\Delta i$ was negligibly small; using triodes, tetrodes, pentodes or certain metal-oxide-type rectifiers, $\Delta i$ was marked but variable. Usually $\Delta i$ was greater with a vacuo-junction than with an oxide type a.c. indicator. This was traced to limitations in the latter's efficiency of rectification. A description, with a diagram, is given of the apparatus used, and a table of data is included. That the applied potential is more important than $i$ is indicated by the absence of the phenomena below the threshold potential required to initiate a discharge; secondary ionization would also appear to be a necessary condition. H. H. HO.

537.525.8 2305

**Interaction of nitrous oxide and hydrogen in the silent discharge.** JOSHI, S. S., AND DESHMUKH, G. S. *Nature, Lond.*, 155, *pp.* 483–484, *April* 21, 1945.—The interaction is sensitive to small changes in the conditions of operation. It sets in only above the threshold potential. Changes in the pressure, and in the ratio of $N_2O$ to $H_2$ affect the reaction considerably. With small pressure ($p$) and large excess of $H_2$, $p$ and $1/i$ ($i$ = conductivity) reach a minimum, and remain constant as the discharge continues. As $p$ increases $1/i$ decreases at first slowly, and then more rapidly. Increase in the proportion of $N_2O$ causes marked changes. At low $p$, after an initial rise, $p$ and $i$ fall to a constant minimum. As $p$ increases, there is a first a large and steep rise in $p$ and $i$, the rate then decreases to a maximum, and then $p$ and $i$ begin to decrease. At larger $p$ there is a periodic effect. There is a close similarity in the time-variation of $p$, $i$, and the energy dissipated in the system. The nature of the glow also varies periodically. Chemical change taking place are suggested on the basis of the change of $p$. In the rhythmic and pulsating reactions the velocity, and not necessarily the direction of the change, varies periodically. In the later stages of the reaction, however, the direction is reversed periodically. The fluctuations were suppressed when the discharge tube was cooled to 7°, and were restored on warming [See Abstr. 2566 (1944)]. A. J. M.

537.525.8 : 535.215 230

**The light-effect under electric discharge: the probability of recombination.** SAHAY, B. K. *Curr. Sci.* 14, *pp.* 122–123, *May*, 1945.—[See Abstr. 983 (1945)]

537.525.8 : 535.215 *see Abstr.* 2217

537.525.8 : 537.312.5 230

**Saturation in the light-effect under electric discharge.** JOSHI, S. S. *Curr. Sci.*, 14, *pp.* 35–36, *Feb.*, 194[illegible] [*See Abstr.* 2304, 2306 (1945)].—The effect of irradiation of $Cl_2$ with light from various parts of the spectrum on the discharge current ha[illegible]

en investigated. The light-effect gave rise to a crease of current, $\Delta i$, of 29% when white light 700–7 800 Å) was used. In the ranges 4 120–4 960, 00–5 780, and 6 000–7 300 Å, $\Delta i$ was 28%, 6%, d 3%, respectively. The effect of the blue is almost ual to that of unfiltered white. $\Delta i$ under blue or uite showed no appreciable difference when irradiated addition with green and/or red. $\Delta i$ due to green s only slightly increased by simultaneous irradiation th red. In general, the sum of the $\Delta i$ produced by nultaneous irradiations in different spectral regions ess than the sum of the separate effects, presumably ing to saturation. These results are in contrast th those of the classical photo-effect. A. J. M.

7.531 : 535.312 : 549.211 : 548.73 2308

**The angular divergence of the X-ray reflections by mond.** RAMACHANDRAN, G. N. *Proc. Indian ad. Sci. A*, 20, *pp.* 245–256, *Nov.*, 1944.—The 4 monds were chosen with widely different intensities fluorescence, the intensities being in the ratio of 4·1 : 23 : 990. The divergence of crystal reflection is measured by a stationary crystal, using a narrow t as the source of X-rays, the characteristic Mo$K\alpha_1$ d $K\alpha_2$ reflected beams being photographed at a ge distance from the crystal. Correcting for the k of monochromatism, the half-widths of the vergence for the specimens were, respectively, 2·7, 8, 13·8 and 21·4 sec. of arc, as compared with the eoretical value 2·0 for a perfect crystal, showing that e more intensely blue-fluorescent a diamond is, the ger is the divergence of the reflection given by it. he integrated intensity of the Bragg reflection should ∝ the half-width of the divergence, and this was e case for 2 of the diamonds.

7.531 : 535.312 : 549.211 : 548.73 2309

**Dynamic X-ray reflections in diamond.** KRISHNAN, . S., AND RAMACHANDRAN, G. N. *Nature, Lond.*, 5, *pp.* 234–235, *Feb.* 24, 1945.—The objections bstr. 1090 (1942)] raised against the interpretation the X-ray reflections observed with diamond given the Bangalore workers [Abstr. 793 (1942)] and 83 (1944)] are believed to be without experimental undation.

37.531 : 535.312 : 549.211 : 548.73 2310

**Extra X-ray reflections from diamonds.** LONSDALE, . *Nature*, 155, *pp.* 572–573, *May* 12, 1945.—[See bstr. 2309 (1945)].

37.531 : 535.34 : 548.73 *see Abstr.* 2589

37.531 : 535.42 : 537.533.73 : 061.22 2311

**Report for 1944 of the American Society for X-ray nd Electron Diffraction.** *Phys. Rev.*, 67, *pp.* 196–98, *March* 1 *and* 15, 1945.—At a joint meeting with he AAAS X-ray Conference, at Gibson Island, Maryland, August 21–25, 1944, the following papers ere presented: Fourier transforms and structure actor, Wrinch, D. [Abstr. 2568 (1945)]; A review of he application of X-ray and electron diffraction nethods to contact catalysis, Milligan, W. O. [Abstr. 592 (1945)]; Diffraction of X-rays by liquid elements, Dingrich, N. S.; Some experimental studies of small ngle scattering, Shull, C. G.; Small-angle diffraction tudies on native protein fibres, Bear, R. S. [Abstr. 384 (1945)]; Long spacing studies of high polymers, Bicek, E. J.; Photography of crystal structures by optical Fourier synthesis, Huggins, M. L. [Abstr. 2596 (1945)]; The comparative evaluation of X-ray powder patterns, Brentano, J. C. M. [Abstr. 2391 (1945)]; Routine quantitative analysis by X-ray diffraction, photometric technique and method, Ballard, J. W.; The precession method of photographing the reciprocal lattice, Buerger, M. J.; The two-circle goniometer in the X-ray laboratory, Tunell, G. [Abstr. 2588 (1945)]; Some new X-ray and electron diffraction techniques, Haworth, F. E.; Some techniques for the growth and preparation of micro-specimens for X-ray diffraction studies, Fankuchen, I. [Abstr. 2585 (1945)].

537.533 : 621.385.832 2312

**A space charge problem.** Moss, H. *Wireless Engr*, 22, *pp.* 316–321, *July*, 1945.—[Abstr. 2145 B (1945)].

537.533 = 3 2313

**On the theory of density-modulated electron beams of finite current density.** BORGNIS, F., AND LEDINEGG, E. *Ann. Phys., Lpz.*, 43, 4, *pp.* 296–310, 1943.—The problems considered are those previously treated by Webster [Abstr. 3463 (1939)] except that there is a discussion of the influence of space charge. The equation of motion of an electron is integrated approximately, and the solution expresses the distance as a cubic polynomial function of the time, the cubic term having a coefficient depending on the space-charge influence. A discussion of this equation (involving the study of a caustic) leads to a limiting current density beyond which the electrons do not overtake one another. A Fourier analysis is made of the current density and the position and magnitude of the maximum value of the amplitude of the fundamental wave is given graphically as a function of the various parameters of the system. L. S. G.

537.533.7 : 537.122 = 4 *see Abstr.* 2291

537.533.7 : 538.3 2314

**Stationary electron swarms in electromagnetic fields.** GABOR, D. *Proc. Roy. Soc. A*, 183, *pp.* 436–453, *June* 18, 1945.—A contribution to the theory of stationary swarms (in axially symmetric fields) without interaction between electrons. The distribution density is calculated on the basis of classical statistical mechanics and it is shown that electrons injected at any point with very small initial velocities will distribute themselves with a density inversely proportional to the distance from the axis, in a certain annular space. Only the limits of this space (not the density distribution within it) depend on the field. The uniform distributions calculated by previous authors are singular solutions, inconsistent with any degree of statistical disorder. Other laws of density distribution may be realized by simultaneous injection of electrons at several points. The possibility of realizing dispersing electron lenses and corrected electron optical systems, using an extended and properly shaped electron source is discussed. It is shown that the ring current produced by the rotating electron cloud can reduce the magnetic field at the axis very considerably in devices of practicable dimensions. It appears also possible to produce clouds of free electrons with densities sufficient for observable optical effects. L. S. G.

537.533.72 : 535.843 : 535.668.1 *see Abstr.* 2261

537.533.72 : 620.178.7 : 620.178.162 : 621.3.085.22 2315

**Meter and instrument jewels and pivots.** SHOTTER, G. F. *Rep. Brit. Elect. Allied Industr. Res. Ass., Ref. T/T*39, 138 *pp.*, 1944.—[Abstr. 1889 B (1945)].

537.533.72 : 621.385.833 2316

**A figure of merit for electron-concentrating systems.** PIERCE, J. R. *Proc. Inst. Radio Engrs, N.Y.*, 33, *pp.* 476–478, *July*, 1945.—[Abstr. 2155 B (1945)].

537.533.73 2317

**The electrical charging of electron diffraction specimens.** BRUBAKER, D. G., AND FULLER, M. L. *J. Appl. Phys.*, 16, *pp.* 128–130, *March*, 1945.—Distortion and shift of electron diffraction patterns made from poorly conducting materials by the reflection method are caused by a charge, usually positive, accumulated on the specimen. The magnitudes of the charges were reduced and their effects on the diffraction patterns made negligible by irradiation of the specimens by a beam of 400 V electrons directed $\perp$ the specimen surface. Both positive and negative charges have been reduced in this way.

537.533.73 : 061.22 : 535.42 : 537.531 *see Abstr.* 2311

537.533.73 : 541.65 2318

**The structure of spiropentane.** DONOHUE, J., HUMPHREY, G. L., AND SCHOMAKER, V. *J. Amer. Chem. Soc.*, 67, *pp.* 332–335, *Feb.*, 1945.—Electron diffraction measurements confirm conclusions from Raman effect data and yield the following dimensions for $C_5H_8$: C–H 1·08 (assumed); $C_3$–$C_1$ 1·48 ± 0·03; $C_1$–$C_2$ 1·51 ± 0·04 Å; angles, $C_2C_3C_1 = 61·5 \pm 2°$, and HCH = 120 ± 8°. W. R. A.

537.533.73 : 621.315.62 2319

**The use of the electron diffraction camera to detect insulating films.** ALESSANDRINI, E. I. *J. Appl. Phys.*, 16, *pp.* 94–96, *Feb.*, 1945.—The camera may be used to distinguish between conducting and insulating surface films on conducting objects since an electron beam on striking an insulating surface charges this surface. The practical use of the camera is described. L. S. G.

537.533.73 : 621.385.833 2320

**Electron diffraction camera viewing screen and photographic plate holder of simple design.** WEBER, A. H., AND DAHM, C. H. *Rev. Sci. Instrum.*, 16, *pp.* 141–143, *June*, 1945.—[Abstr. 2156 B (1945)].

537.533.74 2321

**The calculation of the contribution of freely rotating groups to electron scattering by gases.** KARLE, J. *J. Chem. Phys.*, 13, *pp.* 155–158, *April*, 1945.—The calculation involves the evaluation of the integral

$$I = \frac{1}{2\pi}\int_0^{2\pi} \frac{\sin x\theta}{x\theta} d\beta$$

where $\theta = (1 - p\cos\beta)^{\frac{1}{2}}$. The present paper is an improvement on earlier work by Debye [Abstr. 436 (1941)], in that an asymptotic formula for $I$ is found by the saddle point method (the saddle points, which are turning points of $1 - p\cos\beta$, being $\beta = 0$ and $\beta = \pi$); and this formula allows the error involved in using the Debye formula to be estimated. It also provides additional terms for reducing the error. Two numerical examples, relating to hexamethylethane and biphenyl, are considered. L. S. G.

537.533.74 2322

**The distortion of plane X-wave and its effect on elastic scattering in Coulomb field.** KAR, K. C. *Indian J. Phys.*, 18, *pp.* 144–147, *June*, 1944.—In the wave-statistical theory of elastic scattering previously considered [Abstr. 341 (1938)] the incident electron wave is assumed to be plane. On entering a potential field, perturbation of the wave-function occurs and there is scattering. The distortion of the plane wave brought about by the potential is considered. The modified wave-function is obtained, and it is shown that the distortion is negligible for high speed incident particles and for scattering by light atoms. The distortion of the incident wave has no effect on the relative intensity of scattering. A. J. M.

537.533.79 = 4 232

**Divergence through space charge of a cylindrical non-accelerated beam of electrons.** GOUDET, G., AND GRATZMULLER, A. M. *J. Phys. Radium*, 5, *pp.* 142–149, *July*, 1944.—The beam moves symmetrically between 2 parallel plane electrodes charged to the same potential. An expression is found for the radial component of the electric field at a point on the surface of the beam and the trajectory of a surface electron is studied. The work of Watson [Abstr. 212 (1927)] is generalized. L. S. G.

537.533.79 = 4 232

**Distribution of the potential in a cylindrical electron beam.** GUÉNARD, P. *J. Phys. Radium*, 6, *pp.* 43–47, *Feb.*, 1945.—Two limiting cases are studied. In one the beam, of radius $a$, moves within a metal cylinder of radius $b$, and length $2l$, having plane grids at each end. Poisson's equation is solved, when $b = a$ and also (numerically) when $b > a$. In each case we have $l >> b \geqslant a$. Some numerical and graphical results are given of the potential distribution. The second case consists of a beam moving normally to 2 plane parallel grids separated by a short distance. The potential distribution is now given by an integral which has to be evaluated numerically. L. S.

537.533.8 : 539.166.79 *see Abstr.* 2376

537.534 23

**On some aspects of the modern researches on positive rays.** CHIPLONKAR, V. T. *J. Univ. Bombay*, *pp.* 19–27, *March*, 1945.—A review dealing principally with the interaction between positive rays and matter. The various methods by which the rays may be produced are outlined, and a brief statement of the photographic, thermal, and chemical action is given. The sputtering of metals, and secondary electron emission, as a result of bombardment with positive rays are considered. Ionization produced by impact with positive rays is dealt with, and it is pointed out that it may take place either with electron ejection, or electron exchange. Experiments do not always differentiate between these two. The excitation of light by positive ray bombardment is considered particularly on the basis of Döpel's theory, and a very brief summary of work on scattering is given. A. J.

537.534.74 2

**The elastic scattering and neutralization of low velocity hydrogen ions in methane.** SIMONS, J. H., AND FRYBURG, G. C. *J. Chem. Phys.*, 13, *pp.* 216–2 *June*, 1945.—The low velocity scattering of $H^+$, $H_2^+$, and $H_3^+$ in $CH_4$ was measured at volta

between about 1 and 150. Neutralization is found in all three cases, being much greater for $H_2^+$ and $H^+$ than for $H_3^+$. The elastic scattering is also relatively high compared with $H_2$ and He. It was found that there was an effect of pressure at constant voltage on the experimental determination of effective cross section for elastic scattering. This was explained on the basis of multiple scattering. Approximate potential laws for the interactions were evaluated.

537.534.74 2327

**The elastic scattering and neutralization of low velocity hydrogen ions in ethylene and propylene.** SIMONS, J. H., AND UNGER, L. G. *J. Chem. Phys.*, 13, pp. 221–228, *June*, 1945.—[See Abstr. 2573 (1943)]. Scattering of $H^+$, $H_2^+$, and $H_3^+$ in both $C_2H_4$ and $C_3H_8$ was measured at ion velocities of $< 150$ V. Both elastic scattering and neutralization were obtained over a velocity range. The effect of gas pressure at constant voltage on the total scattering and change of the relative amounts of elastic scattering and neutralization with pressure at constant voltage were discussed. The amount of neutralization compared with elastic scattering is large in all six cases. The elastic scattering in $C_2H_4$ is similar to that in $CH_4$ whereas that in $C_3H_8$ is greater.

537.54 : 535.336.2 *see Abstr.* 2236

537.563 2328

**The Radium Institute cyclotron. I. The arc type of ion source.** ALKHAZOV, D. G., MESCHERYAKOV, M. G., AND CHROMCHENKO, L. M. *J. Phys., USSR*, 8, 1, *pp.* 56–61, 1944.—A description is given of experiments with the 1 m.-cyclotron carried out in 1941 at the Radium Institute. The aim was to investigate the influence of the design of the arc source of the ions, operating conditions of the arc, pressure of working gas, magnetic field, etc., on the output of ions. A method was found for producing ion currents of the order of 60–70 mA at the centre of the cyclotron chamber, and preliminary results are reported concerning the production of deuterons with an energy of 4 eMV. The paper includes a description of the cyclotron vacuum chamber, the method of measurement of high frequency voltage and the source of ions. L. S. G.

537.564 : 537.591.8 2329

**On a bridge method for the measurement of cosmic rays with ionization chambers.** COSTA RIBEIRO, J. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 137–140, 1943.—The method permits the detection of currents of the order of $10^{-16}$ A and this suggests the possibility of using the method for the measurement of ionization currents produced by cosmic rays. The bridge is described and some characteristic curves relating to it are given. An outstanding feature of the apparatus is the unusual use of an electrometer, namely for checking the balance of the bridge circuit. L. S. G.

537.591 : 523.165 2330

**Symposium on cosmic rays.** *Symposium on Cosmic Rays, Acad. Brasileira Ciênc.*, 180 *pp.*, 1943.—A symposium comprising the following papers: On the fluctuations of cosmic rays, Compton, A. H. [Abstr. 2344 (1945)]; Cloud chamber photographs at high altitudes, Hughes D. [Abstr. 2373 (1945)]; The influence of a solar eclipsis on the cosmic ray intensity, Monteux, Y., Occhialini, G., and de Souza Santos, M. D. [Abstr. 2334 (1945)]; Radio wave propagation and cosmic rays, de Oliveira, A. M. [Abstr. 2342 (1945)]; Cosmic-ray studies in the Andes of Southern Peru, Hilberry, N., and Hilberry, A. H. [Abstr. 2345 (1945)]; On the ultra-soft component of the cosmic radiation, Occhialini, G., and Schönberg, M. [Abstr. 2331 (1945)]; On the temperature effect in cosmic radiation, Roser, F. X. [Abstr. 2346 (1945)]; The latitude effect for the hard component of cosmic rays and evidence as to the nature of the primary radiation, Jesse, W. P. [Abstr. 2347 (1945)]; On the production of mesotrons at high altitudes, Wollan, E. O. [Abstr. 2335 (1945)]; On the production of groups of mesotrons by high energy collisions, Wataghin, G. [Abstr. 2336 (1945)]; On a bridge method for the measurement of cosmic rays with ionization chambers, Costa Ribeiro, J. [Abstr. 2329 (1945)]; On the latitude effect of cosmic rays, Gross, B. [Abstr. 2348 (1945)]; On the penetration of electrons in matter, Monteux, Y. [Abstr. 2291 (1945)]; A multivibrator high tension generator, Saboya, J. A. R. [Abstr. 2211 B (1945)]; Showers of penetrating particles under 30 m of clay, Pompeia, P. A., de Souza Santos, M. D., and Wataghin, G. [Abstr. 2337 (1945)]; A cathode following amplifier for pulse transmission in high resolving time coincidence circuits, Hilberry, N., and Pompeia, P. A. [Abstr. 2341 (1945)]; An electrical timing circuit to control a cloud chamber, Pompeia, P. A., and Wollan, E. O. [Abstr. 2200 B (1945)]; Calculation of the plate resistance of a "Rossi" tubes system, Pompeia, P. A., and Wollan, E. O.; Two useful gadgets for controlled Wilson chambers, Occhialini, G., and de Souza Santos, M. D. [Abstr. 1983 B (1945)]; On a method for investigating the influence of cosmic rays on living matter, Wurmser, R.; On the theory of the ionization chamber, Gross, B. [Abstr. 2372 (1945)].

537.591.1 2331

**On the ultra-soft component of the cosmic radiation.** OCCHIALINI, G., AND SCHÖNBERG, M. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 95–104, 1943.—A presentation of results obtained at an altitude of 800 m. in São Paulo. The telescope counter consisted of 2 counters of Al, thickness 0·15 mm. The results of the coincidence experiments are critically examined and compared with those of other authors. L. S. G.

537.591.1 2332

**Decay electrons resulting from fast mesons.** ALICHANOW, A., ALICHANIAN, A., AND MIRIANASHVILLI, G. *J. Phys., USSR*, 8, 1, *pp.* 62–63, 1944.—A report of the results of experiments carried out in the summer of 1942 and 1943 on Mt. Alaghez (Armenian SSR), 3 250 m. above sea level. At a small height (960 m.) the predominant part of the soft component consists of the decay electrons; at a height of 3 250 m. there appears an additional soft radiation, the intensity increasing with the altitude faster than that of the decay electrons. L. S. G.

537.591.1 2333

**Soft component of cosmic rays at an altitude of 3 250 m.** ALICHANOW, A., ALICHANIAN, A., AND NEMENOV, L. *J. Phys., USSR*, 8, 1, *p.* 63, 1944.—

Experiment showed that the ratio of the soft to the hard component depends on the method of measurement and the difference between the values obtained by means of the 3 methods used depends upon the altitude. The only acceptable explanation is the assumption that in the soft component there are also particles with an ionization power greater than that of relativistic particles (probably protons with an energy less than 100 eMV). L. S. G.

537.591.1 : 523.78 2334

**The influence of a solar eclipsis on the cosmic ray intensity.** MONTEUX, Y., OCCHIALINI, G., AND DE SOUZA SANTOS, M. D. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 75–80, 1943.—Apparatus is described for studying cosmic ray variations occurring during small time intervals. The new technique gives a permanent and continuous record of phenomena occurring at a very high rate. The method consists in recording, with a very fast cutter, sharp and short electrical pulses produced by a multivibrator circuit on an acetate record. A safe limit for the duration of the single pulses was found to be $10^{-4}$ sec. Experiments were carried out during the solar eclipsis of Oct. 1, 1940, for the purpose of finding whether the cosmic ray intensity changed, and the experiments were repeated during the eclipsis of March 27, 1941. The results were inconclusive. L. S. G.

537.591.1 : 539.152.1 2335

**On the production of mesotrons at high altitudes.** WOLLAN, E. O. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 123–127, 1943.—A description is given of an experiment whose aim was to show the production of mesotrons by a charged primary particle. The results of experiments show that the primary particle is not an electron but more probably a proton and that for each proton which enters the counter many mesotrons are created. The observation of the production process by means of a cloud chamber is described and a photograph of a meson shower is given. L. S. G.

537.591.1 : 539.152.1 2336

**On the production of groups of mesotrons by high energy collisions.** WATAGHIN, G. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 129–135, 1943.—A simple discussion of the distribution of energy and momenta in a group of mesotrons created in a high energy collision between a primary cosmic ray particle (a proton) and a nucleus at rest in the high atmosphere. The distribution of probabilities is derived from an application of the Lorentz transformation to the collision problem. The general conclusion is that for high energies the number and the average energy, $\bar{E}_\mu$, of the mesotrons are proportional to the square root of the primary energy; and that in each collision the expected spectral distribution of created mesotrons covers a range $E_{max} - E_{min}$ proportional to $\bar{E}_\mu$. L. S. G.

537.591.15 2337

**Showers of penetrating particles under 30 m of clay.** POMPEIA, P. A., DE SOUZA SANTOS, M. D., AND WATAGHIN, G. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 155–156, 1943.—Further experimental results are reported in continuation of earlier work. These seem to indicate that the frequency of showers decreases with depth approximately at the same rate as the intensity of the penetrating particles. L. S. G.

537.591.15 2338

**On the theory of the shower spread.** BELENKY, S. Z. *J. Phys., USSR*, 8, 1, *pp.* 9–12, 1944.—The average spread of the shower particles is evaluated as a function of the energy, ionization losses being considered. The integro-differential equations for the passage of electrons and photons through matter are written down and solved, and the results are presented in graphical form. Ionization losses lead to a considerable decrease of the shower spread, and the dependence of the spread on the energy of the particles is comparatively weak (approximately logarithmic) over a wide energy range. The calculation of the shower spread is of interest in an explanation of "Auger Showers." L. S. G.

537.591.15 2339

**On the interpretation of experiments referring to extensive cascade showers.** POMERANCHUK, I. *J. Phys., USSR*, 8, 1, *pp.* 17–32, 1944.—The solution of the equations of the cascade theory of showers [Abstr. 2424 (1938)] leads to a general expression for the density of particles in large cascade showers as a function of their distance from the axis of the shower. This expression is used to calculate the dependence of the number of coincidences in 2 counters on their mutual distance. The theory is compared with the experimental data of Auger and there is a serious discrepancy between theory and experiment. The existence of a correlation effect is indicated and this leads to an increased probability of coincidences for small distances between the counters. The number of coincidences due to the correlation effect is calculated and the range of distances between the counters for which this effect is of importance is indicated. L. S. G.

537.591.15 234

**Photons associated with a cascade shower.** CHAKRABARTY, S. K. *Bull. Calcutta Moth. Soc.*, 36, *pp.* 135–140, *Dec.*, 1944.—The results of a previous paper [*Pwr Nat. Inst. Sci. India*, 8, (1942), 331] are modified. An expression is obtained for the differential photon spectrum when the effect of ionization loss (previously neglected) is considered together with the other processes. The significance of the results in the theory of cascade showers is discussed. L. S. G.

537.591.15 : 621.314.3 234

**A cathode following amplifier for pulse transmission in high resolving time coincidence circuits.** HILBERRY, N., AND POMPEIA, P. A. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 157–159, 1943.—The circuit of the amplifier is described and its properties are noted. It has been designed primarily for use in cosmic ray shower experiments. L. S.

537.591.15 : 621.396.1 23

**Radio wave propagation and cosmic rays.** OLIVEIRA, A. M. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 81–84, 1943.—A short review of experimental information which has led to the suggestion that certain observed radio echoes originate not from reflection in the permanent layers of the ionosphere but from reflection in ionic clouds of great intensity produced by large cascade showers of cosmic radiation. L. S.

537.591.3 2343

**The absorption of the soft component in water at an altitude of 3 225 m.** ALICHANIAN, A., ALICHANOW, A., KOCHARIAN, N., KVARZ'HAVA, I., AND MIRIANASHVILLI, G. *J. Phys. USSR*, 8, 2, *pp.* 127–128, 1944.—Results are recorded of the measurements of the ratio of the intensities of the soft and hard components of cosmic rays by means of an ionization chamber, counters and a coincidence method. L. S. G.

537.591.5 2344

**On the fluctuations of cosmic rays.** COMPTON, A. H. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 59–66, 1943.—A review of recent theories regarding the origin of cosmic rays and of experiments designed to study the time variation of cosmic ray intensity. There is some evidence for a variation of the intensity with sidereal time but the magnitude of the effect is certainly less than predicted by the theory based on rays coming from outside the galaxy. L. S. G.

537.591.5 2345

**Cosmic-ray studies in the Andes of Southern Peru.** HILBERRY, N., AND HILBERRY, A. H. *Symposium on Cosmic Rays, Acad. Braseileira Ciênc., pp.* 85–93, 1943.—Experimental results are reported relating to (i) the directional properties of cosmic-rays at low magnetic latitudes and (ii) the variation in the numbers of extensive cosmic-ray showers with altitude. The experiments were carried out at altitudes of 4 750 m. and 5 850 m. L. S. G.

537.591.5 2346

**On the temperature effect in cosmic radiation.** LOSER, F. X. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 105–112, 1943.—A discussion of the origin of the temperature effect and its relation to the production of mesotrons in the atmosphere, on the basis of observations made at Hafelekar from 1936 to 1937. Blackett's theory is critically examined. L. S. G.

537.591.5 2347

**The latitude effect for the hard component of cosmic rays and evidence as to the nature of the primary radiation.** JESSE, W. P. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 113–121, 1943.—Apparatus is described for detecting and recording individual cosmic rays coming in a vertical direction in the stratosphere. A curve is given showing the number of counts per minute as a function of atmospheric pressure for the geomagnetic latitudes of Chicago (51°N.) and Waco, Texas (40°N.). As a result of experiments it is concluded that the primary cosmic rays entering the atmosphere consist mainly of protons. L. S. G.

537.591.5 2348

**On the latitude effect of cosmic rays.** GROSS, B. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 141–145, 1943.—A theoretical discussion of possible causes of the 36° knee in the intensity/latitude curve of cosmic rays at sea level. The assumption made is that the absorption of the charged particles responsible for the latitude effect is considerably affected by straggling. The main conclusions are: (i) the form of the knee in the latitude curve depends to some extent on the nature of the energy loss and it flattens with increasing straggling, (ii) the absence of a knee in the absorption curve can be accounted for by straggling, (iii) the shift of the critical latitude with the depth is independent of the nature of the energy loss. L. S. G.

537.591.5 2349

**Latitude effect for mesons.** BHABHA, H. J., AIYA, S. V. C., HOTEKO, H. E., AND SAXENA, R. C. *Curr. Sci.*, 14, *pp.* 98–99, *April*, 1945.

537.591.8 : 537.564 *see Abstr.* 2329

537.591.8 : 539.16.08 *see Abstr.* 2373

537.723 2350

**Measurements of the specific resistance of the human body to direct current.** BURGER, H. C., AND VAN MILAAN, J. B. *Acta Med. Scand.*, 114, *pp.* 584–607, *Aug.*, 1943.—The methods of measurement, tests, inhomogeneous current distribution, results of the measurements, and the anisotropy of the muscular tissue are discussed. The influence of the resistance of the skin is eliminated by measuring p.d.'s on the skin with a triode voltmeter which needs no current for its indication. Values of the specific resistance of different parts of the body do not differ appreciably but are larger than is to be expected for a physiological salt solution. This is ascribed to the influence of the cell-membrane. The bones in the arm cannot account for the difference of specific resistance along the arm; the elbow joint has no extra resistance. Anomalies of the conductance of the arm can be explained by an isolating layer of fat, and by an anisotropy of the electrical conductance through a muscle. The trunk is less conducting than the arm, partly due to the air in the lungs. The skull has an appreciable isolating influence, but the current enters the brain rather easily through the temples. Blood is only slightly more conductive than the mean human tissue, and current does not preferably follow blood vessels. Blood plasma is more conductive than blood owing to the absence of the membranes of the erythrocytes which are not easily penetrated by ions. C. J. G.

538.082.1 : 538.71 : 621.317.44 2351

**An improved magnetometer.** SUCKSMITH, W. *J. Sci. Instrum.*, 22, *p.* 129, *July*, 1945.—Two small Alcomax II magnets, 5 × 1 × 1 mm., are fixed one on each side of the lower edge of a strip of mica, which carries a small mirror and is suspended by means of a cocoon-silk fibre. The magnets hang in a conical recess in the end of a Cu rod and their height above the bottom of the recess is adjusted to give the damping required. At critical damping the magnets are usually 1–2 mm. from the bottom of the recess. With this arrangement, the time required to take up the equilibrium position is $\gtrsim$1 sec. In addition to laboratory applications, the quick response of the magnetometer would prove useful in the routine testing of small permanent magnets not easily amenable to ballistic methods on account of inadequate sensitivity. A. W.

538.114 : 621.318.22 2352

**Magnetic materials. I–III.** BRAILSFORD, F. *Electronic Engng*, 17, *pp.* 142–145, *Sept.*; 192–195, *Oct.*, *and pp.* 248–250, *Nov.*, 1944.—[Abstr. 2060 B (1945)].

[538.13 + 538.22] : 621.3.082.78 2353

**Basic concepts of moving-magnet-instrument rotors.** MENDELSOHN, L. I. *Trans. Amer. Inst. Elect. Engrs*, 64, *pp.* 529–534, *July*, 1945.—[Abstr. 1887 B (1945)].

538.214 2354

**Magnetic properties of some paramagnetic crystals at low temperatures.** GUHA, B. C. *Nature, Lond.*, 155, *p.* 364, *March* 24, 1945.

[538.22 + 538.13] : 621.3.082.78 *see Abstr.* 2353

538.23 = 3 2355

**Hysteresis in the Rayleigh range of weak magnetic fields with sheared magnetization curves.** KORNETZKI, M. *Elekt. Nachr. Tech.* [*ENT*], 20, *pp.* 10–17, *Jan.*, 1943.—It is shown by calculation that the magnetization curve of a sheared magnetic material cannot be a Rayleigh loop, if the unsheared material follows the Rayleigh law. The shear-formula applies theoretically only to infinitely small field strengths. Results of tests are given for a number of magnetic materials, and quantitative deviations from theory are considered. E. R. A.

538.3 : 537.533.7 *see Abstr.* 2314

538.3 : 621.365.3 2356

**The pinch effect: an electrostatic phenomenon.** HOWE, G. W. O. *Wireless Engr*, 22, *pp.* 105–118, *March*, 1945.—At a current density of 10 000 amp./cm.$^2$ the drift velocity of the electrons is 0·75 cm./sec.; each cm$^3$ contains $84 \times 10^{21}$ electrons. Taking a copper wire 1 cm. dia. carrying 10 000 amp. there is a radial drift of electrons towards the centre, resulting in an increase of 90 electrons per cm$^3$ at the centre before the radial electrostatic field restores the balance; the change is thus entirely negligible as far as current density is concerned, but the atoms at the periphery, having provided the electrons, are positively charged, and experience a force towards the centre which is proportional to the distance from the centre and the square of the current density, i.e. the cube of the radius. The hydrostatic pressure being inversely proportional to the square of the radius, the formation of a waist results in instability and a pinch occurs.

G. F. F.

538.3 = 4 2357

**Conception of the electromagnetic field in Dirac's theory.** BECK, G. *Portugaliae Physica*, 1, 3, *pp.* 93–94, 1944.—It has been shown that the Dirac theory may be interpreted in such a way as to define the electromagnetic field of a polarizable and magnetizable vacuum. The phenomenological point of view considers a system to be made up of two distinct parts—particle and field. This is not satisfactory as the basis of a theory of the electron and the electromagnetic field. The variables required for a description of the electron and field are enumerated, and it is shown that the Dirac equations contain implicitly the notion of a field, even in the case of a vacuum. A. J. M.

538.51 : 621.396.671 = 82 2358

**Physical bases of "induced e.m.f." methods.** MEYEROVICH, L. *Bull. Acad. Sci., USSR Dep. Tech. Sci., No.* 12, *pp.* 804–810, 1944.—[Abstr. 2223 B (1945)].

538.54 : 536.2 = 4 2359

**On the heating, by Foucault currents, of a sphere and an ellipsoid of revolution, elongated or flattened.** JOUGUET, M. *C.R. Acad. Sci., Paris*, 216, *pp.* 725–726, *May* 31, 1943.—Formulae are obtained for the power transformed into heat in an ellipsoid of revolution placed in a uniform alternating magnetic field parallel to the axis. The limiting cases considered are very low and very high frequencies. The results are applied to the approximate calculation of the power absorbed by a cylinder of finite length, and some numerical cases are considered. L. S. G.

538.56.029.6 : 523.16 *see Abstr.* 2112

538.652 = 4 2360

**Magnetization of nickel by unilateral compression.** PALACIOS, J., AND CALVO, L. L. *Portugaliae Physica*, 1, 3, *pp.* 77–91, 1944.—The relations between magnetostriction and magnetization due to mechanical forces are discussed. The longitudinal magnetization of a Ni rod was measured as a function of the longitudinal pressure, the excitation being maintained constant. In the present case, the external field was zero. It was found that the magnetostriction of Ni for a zero magnetic field is independent of pressure. A. J. M.

538.7 : 527(09) 2361

**Some early contributions to the history of geomagnetism. VIII.** HARRADON, H. D. *Terr. Magn. Atmos. Elect.*, 50, *pp.* 63–71, *March*, 1945.—[See Abstr. 638 (1945)].

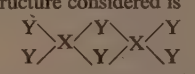
538.71 : 621.317.44 : 538.082.1 *see Abstr.* 2351

538.74 : 531.383 : 629.135 : 621.3.083.7 2362

**Distant-reading gyro-magnetic compass.** *Engineering*, 159, *pp.* 406–408, *May* 25, 1945.—[Abstr. 1888 B (1945)].

539.132 : 535.338.42 : 536.63 2363

**The normal vibrations of bridged $X_2Y_6$ molecules.** BELL, R. P., AND LONGUET-HIGGINS, H. C. *Proc. Roy. Soc. A*, 183, *pp.* 357–374, *June* 18, 1945.—The bridged structure considered is



and this applies to the dimeric trihalides of Al, In and Ga [Abstr. 1688 (1941), 3890 (1938)], and also to the hydrides $B_2H_6$ and $Ga_2H_6$. Symmetry classes and selection rules are given and equations for the normal vibration frequencies are derived from valency force treatment. For the bending vibration in which the potential energy $\propto$ 4th power of the displacement a special treatment is needed [Abstr. 1534 (1945)]. An application is made to the spectrum of diborane; the observed infra-red and Raman spectra may be satisfactorily assigned on the basis of the proposed model, 15 out of the 17 active fundamentals being observed. The 15 frequencies are accurately predicted. The observed and calculated frequencies are used to calculate the specific heat in the range 100–300°K. and the values obtained agree well with experiment. The bearing of these results upon the molecular structure of diborane is discussed. A simplified form of the frequency equations is used to calculate the Raman frequencies of the dimeric halides of Al. The results are in semi-quantitative agreement with the observed frequencies. L. S. G.

539.133 2364

**The dipole moments of catechol, resorcinol and hydroquinone.** LANDER, J. J., AND SVIRBELY, W. J. *J. Amer. Chem. Soc.*, 67, *pp.* 322–324, *Feb.*, 1945.—Dipole moments of *o*–, *m*– and *p*–dihydroxy–benzene in benzene are 2·62, 2·07 and 1·4 debyes respectively. Agreement between calculated and experimental values for catechol suggest a *cis*-planar structure

volving a weak hydrogen bond. Comparison of alculated and experimental values for resorcinol and ydroquinone show planar configurations to be more ceptable than the structures assuming either free or artially restricted rotation of the hydroxyl groups.
W. R. A.

39.133 2365
**Dipole moments of some sex hormones, sterols and ophorene.** KUMLER, W. D., AND FOHLEN, G. M. *Amer. Chem. Soc.*, 67, *pp.* 437–441, *March*, 1945.—[See Abstr. 211 (1943)]. The dipole moments of eight androstane derivatives, four sterols and isophorone ere measured in dioxane solution. The moments of our compounds fall outside the range calculated for ree rotation of the hydroxyl groups, from which it is oncluded that the 3$\beta$- and 17$\beta$-hydroxyl groups do ot have freedom of rotation. A ketone group onjugated with a double bond in a six-membered ng has a moment about 1 unit higher than a simple etone. The dipole moment of isophorone indicates hat the compound exists chiefly in a form with the ouble bond conjugated with the ketone group. double bond in the sterol nucleus that is not conugated decreases the moment of the compound by ·49 unit in the one case studied. Two explanations re discussed. Sterols with two polar groups and iffering only in the position of a hydroxyl group on he same carbon atom, have different moments.

39.133 : 541.57 2366
**An investigation of the occurrence of the co-ordinate r dative link by electric dipole-moment measurements.** PHILLIPS, G. M., HUNTER, J. S., AND SUTTON, L. E. *Chem. Soc.*, *pp.* 146–162, *March*, 1945.—Dipole-moment measurements are reported. The changes of moment which occur when phosphines and sulphides orm links to oxygen or sulphur are compared with hose when they form *complexes* with boron trifluoride or trichloride, in which the boron must accept co-ordinate link, and these in turn with the changes hen amines or ethers form links to the same atoms r groups. The results, considered together with hermal data, show that the older formulations are much nearer the truth than the newer ones. The emarkable shortening of the links to less than the alues expected for double bonds is shown to be an xample of a rather general phenomenon.

39.133 : 541.57 *see Abstr.* 2514, 2515

39.15 2367
**Atomic and molecular theory since Bohr: résumé of pecific results.** MARGENAU, H., AND SETLOW, R. B. *mer. J. Phys.*, 13, *pp.* 73–95, *April*, 1945.—A review f developments consequent upon the introduction f quantum mechanics into the fields of spectroscopy, tra- and inter-molecular forces, the nature of metals, agnetism, and nuclear physics is given. Advances in perimental work are briefly summarized in connection with the cyclotron, the betatron, and the ectron microscope. A. J. M.

39.152.1 : 530.12 *see Abstr.* 2144

39.152.1 : 531.51 2368
**Relationship between nuclear force and gravitational orce.** WANG, K. C., AND TSAO, H. L. *Nature, ond.*, 155, *pp.* 512–513, *April* 28, 1945.—If it is ssumed that nuclear forces have a potential $= -Ae^{K/r}$ and that this is identical with the gravitational force of potential $V = -GMM'/r$, to the first approximation in $1/r$, there results the equality $AK = GMM'$. If $M$ and $M'$ refer to two protons and $K$ is the Compton wavelength of the electron, the deduced value of $A$ and hence of $V$ is only slightly smaller than the experimental value. Other possible mathematical functions for the nuclear potential are briefly discussed. G. C. McV.

539.152.1 : 537.591.1 *see Abstr.* 2335, 2336

539.152.1 = 6 2369
**A new representation of the types of nuclear forces.** BUNGE, M. *Publ. Fac. Cienc. Fis.-Mat. La Plata*, 3, *pp.* 221–239, *Oct.*, 1944.—A review of the characteristics of the usual representations of nuclear forces. Operators, formally identical with those occurring in Dirac's relativistic theory of the electron, are introduced and these are used to give an account of the 4 quantum states of the nucleon in non-relativistic approximation. With the new notation, explicit use of the "isotopic spin" is excluded, this being synthesized with the ordinary spin in a single 4-valent variable. The new operators are used to form the theoretically possible scalar and non-relativistic potentials, use being made of symmetry and invariance criteria. An application is made to the deuteron problem and the advantages and limits of the representation are discussed. L. S. G.

539.153 : 530.145.6 2370
**Energy levels of strongly bound electrons in metal.** GEYLIKMAN, B. T. *J. Phys., USSR*, 8, 2, *pp.* 115–126, 1944.—The energy levels are found on the basis of a translation model (for the motion of the electrons) which takes into account the exchange effect. The treatment is wave-mechanical and it is an improvement on the work of Heisenberg [Abstr. 2835 (1928)] and Bloch [Abstr. 2925 (1930)]. L. S. G.

539.153.4 : 523.872 : 537.228.5 *see Abstr.* 2297, 2298

539.154 = 3 2371
**The atomic constants $e$, $e/m_0$ and $h$.** STILLE, U. *Z. Phys.*, 121, 3–4, *pp.* 133–200, 1943.—In connection with the general viewpoint established earlier [Abstr. 2218 (1944)] the experimental data available for determining the values of the atomic constants are summarized and examined. The relation between the atomic constants and the experimental values for the Rydberg constant and the fine-structure constant is investigated. H. G. S.

539.155.2 : 535.336.2 *see Abstr.* 2235

539.155.2 : 537.54 : 535.336.2 *see Abstr.* 2236

539.155.4 : 537.12 *see Abstr.* 2289

539.16.08 2372
**On the theory of the ionization chamber.** GROSS, B. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc.*, *pp.* 171–176, 1943.—The precision and reliability of cosmic ray measurements with the ionization chamber depend largely upon the performance of the insulator, the voltage across which may vary with time in any manner. A theory is outlined in which the chamber is considered as an element of an electric circuit and an integro-differential equation is derived for the voltage across the insulator. The paper is devoted to a discussion of this equation. L. S. G.

539.16.08 : 537.591.8 2373
**Cloud chamber photographs at high altitudes.** HUGHES, D. *Symposium on Cosmic Rays, Acad.*

*Brasileira Ciênc., pp.* 67–73, 1943.—A large number of photographs are shown and the information obtained from these regarding the mesotron and the composition of cosmic radiation is discussed. This relates not only to the mass of the mesotron but also to its origin and eventual fate and information is also derived concerning several other types of rays that may be present in cosmic radiation. L. S. G.

539.16.08 : 621.316.549 2374

**Two useful gadgets for controlled Wilson chambers.** Occhialini, G., and de Souza Santos, M. D. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 165–168, 1943.—[Abstr. 1983 B (1945)].

539.16.08 : 621.396.611.1 2375

**An electrical timing circuit to control a cloud chamber.** Pompeia, P. A., and Wollan, E. O. *Symposium on Cosmic Rays, Acad. Brasileira Ciênc., pp.* 161–162, 1943.—[Abstr. 2200 B (1945)].

539.165 : 539.172 = 4 *see Abstr.* 2378

539.166.79 : 537.533.8 2376

**An investigation of "Bremsstrahlung" by means of excited $In^{115}$ nuclei.** Korsunsky, M. I., Walther, A. K., Ivanov, A. V., Zypkin, S. I., and Ganenko, V. E. *J. Phys., USSR,* 7, 3, *pp.* 129–137, 1943.—The excitation of the metastable state of $In^{115}$ nuclei was investigated by means of X-rays which were produced by electrons with an energy between 1·04 and 1·50 eMV, retarded by a thin Au foil and a thick Be plate. The excitation threshold energy for these nuclei was found to be 1 070 ± 50 ekV, which is the energy of the activation level. The isochromates ($h\nu_a$ = 1 070 ± 50 ekV) for the "Bremsstrahlung" of electrons from thick leaf Be and thin leaf (8·9 mg. cm.$^{-2}$) Au targets were measured and the values were found to coincide with those calculated by the Bethe–Heitler theory [Abstr. 3411 (1934)]. The experimental results are at variance with those of some previous authors. L. S. G.

539.166.92 : 591.1.044 2377

**The effect of variations in the dose-rate of gamma radiation on cell degeneration in the frog tadpole.** Glucksmann, A., Tansley, K., and Wilson, C. W. *Brit. J. Radiol.,* 18, *pp.* 158–164, *May,* 1945.—The effects of ionizing radiations in changing the mutation rate in certain plants and insects has been shown to be independent of the dosage rate, at which the radiation is delivered. With the chick embryo it has however been found that mitosis is dependent upon the rate of dose application. Since the cell degeneration is of importance in tumour treatment the effect of dosage rate, as administered by gamma radiation, has been investigated in respect to the frog tadpole. The technique of the investigations is described in detail for irradiation at five different dose-rates. The results show that the effect on the brain and the eye is one of increasing degeneration with increase of the dose-rate, the interval between irradiation and time of reaction increasing with the dose-rate, and there is an optimal degeneration with a dose-rate of 15 r./min. B. J. L.

539.172 : 539.165 = 4 2378

**Investigation of the transmutation Ra D → Ra E by magnetic spectrography of the β-radiation of internal conversion.** Braga, C. A. C. *Portugaliae Physica,* 1, 3, *pp.* 159–163, 1944.—The results obtained by the investigation of the β-radiation in the conversion Ra D → Ra E by magnetic spectrography do not agree with those formerly obtained by absorption methods. The magnetic method has therefore been improved and the radiation re-investigated. The results obtained are in satisfactory agreement with those previously obtained by this method. A. J. M.

539.172.3 2379

**The nuclear excitation of rhodium.** Wiedenbeck, M. L. *Phys. Rev.,* 67, *pp.* 267–268, *April* 1 *and* 15, 1945.—A very strong activity was produced by direct irradiation of Rh counters with X-rays produced with the Van de Graaf–Herb electrostatic generator, the decay period being 45 ± 1 min. The radioactivity is assigned to a low lying metastable state in $Rh^{103}$ (99·9% abundant) produced in the reaction $Rh^{103} + \gamma \rightarrow Rh^{103}$. L. S. G.

539.185 2380

**Scattering of neutrons by protons.** Goloborodko, T. A. *J. Phys., USSR,* 8, 1, *pp.* 13–16, 1944.—Experimental values of the scattering cross-section, $\sigma$, are found for photoneutrons of energies 0·1, 0·2, 0·3 and 0·4 eMV. The values are 9·0, 3·0, 8·5 and $3{\cdot}2 \times 10^{-24}$ cm.$^2$ respectively, and these are in agreement with previous experimental values; the dependence of $\sigma$ on the neutron energy does not agree with that required by Wigner's formula [Abstr. 2929 (1936)]. L. S. G.

539.185 2381

**Anomalous scattering of photoneutrons by nuclei of heavy elements.** Goloborodko, T. A. *J. Phys., USSR,* 8, 2, *pp.* 106–109, 1944.—The values of the elastic scattering cross-sections of photoneutrons in Cr, Mn, Se, W and Pb were measured, and the absolute values oscillate regularly with varying energy of the photoneutrons. Assuming the scattering to be elastic it seems that the existing nuclear theory is unable to explain the phenomena as a resonance interaction. It is probable that they are connected with an inner structure not considered by the statistical theory of heavy nuclei. L. S. G.

539.185 = 3 2382

**An approximate formula for the effective reaction cross-section $\sigma_{eff}$ of slow neutrons for a 1/$v$-absorber.** Koyenuma, N. *Ann. Phys., Lpz.,* 43, 4, *pp.* 279–284, 1943.—The formula for $\sigma_{eff}$ is

$$\sigma_{eff} = \frac{1}{n}\log\left\{\left(\int_0^\infty x^2\epsilon^{-x^3}dx\right)\Big/\left(\int_0^\infty x^2\epsilon^{-x^3-s/x}dx\right)\right\}$$

and the paper is devoted to an approximate evaluation of $\int_0^\infty x^2\epsilon^{-x^3-s/x}dx$ for positive values of $s$. L. S. G.

539.215.4 : 548.73 *see Abstr.* 2590

539.216.1 238

**The lepidometer—an instrument for measuring the scaliness of animal fibres.** Speakman, J. B., Chamberlain, N. H., and Menkart, J. *J. Text. Inst., Manchr* 36, *T*91–*T*106, *May,* 1945.—The lepidometer gives the maximum tension developed when single fibres are suspended, root end downwards, from a tension measuring device, and rubbed between rubber or polythene surfaces. Measurements can be carried out in air or in aq. solutions.

539.216.1 : 539.26 2384

**Small-angle diffraction studies on protein fibres.** BEAR, R. S. *Phys. Rev.*, 67, *p.* 196, *March* 1 *and* 15, 1945.—A survey of the small-angle patterns of collagen (tendon), α-keratin (porcupine quill), β-keratin (feather) and clam muscle has disclosed the following: (1) 20 to 40 or more layer lines are observable on the patterns. The layer line positions lead to the following values for the fibre-axis periods: 95, 198, 640 and 425 Å, for feather, porcupine quill, collagen and clam muscle, respectively, and for normal dried materials. (2) In most of the protein fibre diagrams, the larger part of the diffractions occur on the meridian of the pattern and on prominent row lines, one to each side of the meridian. The lateral spacings calculable from the row lines are 34, 83, and about 425 Å for feather, porcupine quill and clam muscle, respectively. Collagen patterns show no large spacings other than those on the meridian. (3) Collagen is also distinctive in the manner of intensification of the meridional diffractions. The first order is predominant and corresponds to a slowly changing, longitudinal density variation extending over the entire 640 Å period. This can be seen in electron microscope photographs of collagen fibrils as a banded structure of the same average period length. The other fibres yield patterns whose innermost intense meridional orders are higher than the first. (4) The diffuse wide-angle interferences are clusters of very high orders of the large fundamental spacings. (5) In other respects, the wide-angle and small-angle diffractions seem independent.

539.216.1 : 539.42 : 677.2 2385

**The tensile behaviour of raw cotton and other textile fibres.** MEREDITH, R. *J. Text. Inst., Manchr*, 36, *T*107–*T*130, *May*, 1945.—Different fibres have been compared under the same conditions, viz. a length of 1 cm., a relative humidity of 65%, a temperature of 20°C., and a rate of loading of 10 g. per denier per min. A brief review of existing literature on the strength of fibres precedes the new data. The fibre characters measured are fineness, fibre strength, extensibility, yield stress and strain, work of rupture, and variation within a sample. The fibres tested include cotton, bast, and other vegetable fibres, rayons, silk, wool, hair and caseins, and the synthetic fibres nylon and vinyon. Sampling and experimental methods are described. The mean values for the above fibre characters are tabulated and include the standard errors for fineness, breaking load, specific strength and extension at break. A very comprehensive discussion of the results is illustrated by numerous curves. The bibliography contains 55 references. H. H. HO.

539.216.1 : 677 : 519.283 2386

**A new method of measuring the irregularity of yarns with some observations on the origin of irregularities in worsted slivers and yarns.** MARTINDALE, J. G. *J. Text. Inst., Manchr*, 36, *T*35–*T*47, *March*, 1945.—The method enables weighings of a large number (1 600) of inch lengths to be made accurately and quickly in simple apparatus. It is suggested that drafting waves are only partly responsible for the irregularity of worsted yarns. An examination of the worsted processes is made to show that one can legitimately infer that even the most perfect drafting equipment with full control of short fibres would not give a uniform sliver or yarn, but only one in which the fibres were arranged at random. The degree of irregularity of thickness arising from such a random fibre arrangement can be calculated and a formula is developed from which the calculation can be made. This shows that the irregularity arising from this kind of fibre arrangement is dependent only on the mean number of fibres per cross-section and the variability of the fibre thickness, and is independent of any other fibre properties including length or variability of length. Experimental results are given showing that, in the case of worsted slivers and yarns, the measured irregularity is always greater than that which would arise solely from a random fibre arrangement. One of the interesting features of the results is the large part of the irregularity of fine rovings and yarns which must be ascribed to the effect of a random arrangement of fibres, rather than to uncontrolled short fibre movement during drafting.

539.216.2 : 539.217.2 : 679.5 2387

**Water-resistant films of plastic materials.** RITCHIE, P. D., AND KIRKWOOD, I. W. A. *Engng Mater.*, 3, *pp.* 51–53, *April*, 1945.—Three methods of application of water-resistant plastic material are available: (1) dipping or spraying; a highly plasticized ethyl cellulose (Ethocel) has been used, while aircraft have been prepared for sea transport by spraying with plasticized Vinylite resin; (2) wrapping in an impermeable film of the cellophane type; (3) wrapping with a reinforced composite or laminated sheet such as Pliofilm (rubber hydrochloride) with Kraft paper to give it strength. The permeability of plastic films to water vapour is 40–50 for cellophane, 45 for plasticized cellulose acetate, 13 for a bitumen/Kraft paper sandwich, 5 for soft vulcanized rubber, 5 for fibre-glass fabric coated with synthetic rubber, 1·5–4·5 for waterproofed cellophane, diophane, etc., 3·5 for polystyrene, 0·8 for soft plasticized polyvinyl chloride, and 0·2 for Pliofilm. The type and amount of plasticizer employed has a marked effect on the permeability of the film. Some applications are described. A. C. W.

539.217.1 : 677 2388

**The porosity of textile materials.** SIEMINSKI, M. A., AND HOTTE, G. H. *Rayon Text. Mon.*, 25, *pp.* 608–610, *Dec.*, 1944.—The porosity of a material is defined as the ratio of the volume of air or void contained within the outermost boundaries of the material to the total volume enclosed by these boundaries. The permeability of a material can be defined as the rate of flow of fluid under a differential pressure through an area of the material. Current technique for the determination of porosity of a textile material is discussed and the correlation of porosity with other fabric properties is considered. C. J. G.

539.217.2 : 679.5 : 539.216.2 *see Abstr.* 2387

539.217.3 : 677.01 : 532.696.1 *see Abstr.* 2187

539.217.5 : 677.65 2389

**The air permeability of mosquito netting.** LOMAX, J. *J. Text. Inst., Manchr*, 36, *pp. T*60–*T*66, *March*, 1945.—An account is given of experiments in which mosquito netting, mounted in a circular frame, is moved through air at a low speed at the end of a pendulum, the resistance being measured by the damping action of

the netting in reducing the number of oscillations which the pendulum would make in losing so many degrees amplitude of swing. A full description of the apparatus is given with illustrative data and testing conditions. This pendulum test appears suitable as an alternative method for ranking, as regards air permeability, mosquito or any other netting with an air resistance too low for measurement by the normal method of mounting a sample of the fabric over an orifice, and drawing through it a current of air at a fixed speed. H. H. HO.

539.23 : 620.178.14 2390

**Durability tester for coated optical elements.** TOWNSLEY, M. G. *Rev. Sci. Instrum.*, 16, *pp.* 143–146, *June*, 1945.—[Abstr. 1826 B (1945)].

539.26 2391

**The comparative evaluation of X-ray powder patterns.** BRENTANO, J. C. M. *Phys. Rev.*, 67, *p.* 197, *March* 1 *and* 15, 1945.—Methods are discussed for evaluation of the individual line of a powder diffraction pattern, improving the intensity distribution of a line and utilizing the line groups of the chemical or morphological constituents of a mixed powder for evaluating the relative amounts present. For obtaining the integrated intensities of a line, it is proposed to measure the X-ray exposure by the intensity of the (111) reflection of the silver forming the photographic image. The uneven intensity distribution can be improved by recording the line pattern on a film rocked with uniform velocity through a range wider than the central dense part of the line, but smaller than its foot. A rapid way of carrying out the actual point-to-point evaluation by absorption densitometry was found by superposing on the micro-densitometer tracing of the line pattern that of a stepped wedge, both recorded with the same densitometer setting. To determine, in the quantitative evaluation of the lines of a mixed powder, which lines can be utilized and which are affected by superpositions, a separate pattern is taken for each constituent.

539.26 : 539.216.1 *see Abstr.* 2384

539.26 : 541.182.6 2392

**X-ray diffraction study of micelle structure in potassium laurate solutions.** HUGHES, E. W., SAWYER, W. M., AND VINOGRAD, J. R. *J. Chem. Phys.*, 13, *pp.* 131–132, *March*, 1945.—Evidence of ordered aggregates of micelles in isotropic soap solutions is confirmed by a study of the K laurate–water–toluene system which shows that the long spacing decreases linearly with soap concentration, and that the increase in long spacing on addition of hydrocarbon (toluene) $\propto$ the mole ratio of additive soap. The proposed micelle structure is supported by observations of the changes in line intensity when substances are solubilized, and the effect of a solubilized additive on long spacing depends markedly on its chemical nature. Results indicate that the additive does not all layer between the ends of the soap chains but that a portion is absorbed elsewhere, probably between the sides of the aliphatic chains in the micelles or within ionic micelles not detected by X-rays. N. M. B.

539.26 : 548.73 2393

**The future of X-ray analysis.** BERNAL, J. D. *Nature, Lond.*, 155, *pp.* 713–715, *June* 16, 1945.—[See Abstr. 2394, 2395 (1945)].

539.26 : 548.73 : 621.386 2394

**Conference on X-ray analysis.** *Nature, Lond.*, 155, *pp.* 643–645, *May* 26, 1945.—The second Annual Conference of the X-Ray Analysis Group of the Institute of Physics, and the fourth Conference on X-Rays in Industry.

539.26 : 548.73 : 621.386 2395

**Summarized proceedings of Conference on X-ray analysis—London, 1945.** *J. Sci. Instrum.*, 22, *pp.* 131–138, *July*, 1945.

539.26 : 620.179.152 2396

**Non-destructive testing of metals and alloys.** DONALDSON, J. W. *Drop Forger*, *pp.* 26–34, *May*, 1945.—[Abstr. 1839 B (1945)].

539.26 : 621.386.083 = 4 2397

**Scaling and measurement by a stereo-radiographic transposition method.** CHAUSSÉ. *J. Radiol. Electrol.*, 26, 3–4, *pp.* 84–85, 1944–1945.

539.261 : 621.386 2398

**A method for X-ray examination of systems containing varying amounts of a volatile component.** MARSDEN, S. S., JR. *Rev. Sci. Instrum.*, 16, *pp.* 192–193, *July*, 1945.—[Abstr. 2157 B (1945)].

539.313 2399

**The general theory of stresses and displacements in layered systems. I–III.** BURMISTER, D. M. *J. Appl. Phys.*, 16, *pp.* 89–94, *Feb.*; 126–127, *March*, *and pp.* 296–302, *May*, 1945.—Problems encountered in airport and foundation engineering frequently involve the consideration of stresses and settlements in layered soil deposits. A general theory is developed, including the derivation of the basic equations of the stresses and settlements in a two-layer system, and the numerical evaluation of the surface settlement equation for the simplest case of Poisson's ratio equal to $^1/_2$ is carried out. The results are presented in the form of influence curves and these are useful in the analysis of practical problems. The theory is extended to the case of 3 layers with full continuity across the interfaces between the layers. The 3-layer settlement equation at the surface of the ground is also derived. L. S. G.

539.319 : 621.791.75 2400

**Shrinkage distortion in welding.** SPRARAGEN, W., AND CORDOVI, M. A. *Weld. J.*, *pp.* 545*s*–559*s*, *Nov.*, 1944.—A summary of the results of experimental investigations carried out during 1937–1944. Non-American literature prior to Jan. 1, 1941, is also reviewed. The information is qualitative rather than quantitative, and is concerned mainly with methods of distortion control. Shrinkage perpendicular and parallel to a butt weld, and angular distortion, are given first consideration. M.-V.

539.319 : 666.1.038 2401

**Relaxation of stresses in annealing glass.** TOOL, A. Q. *J. Res. Nat. Bur. Stand., Wash.*, 34, *pp.* 199–212, *Feb.*, 1945.—An empirical equation representing relaxation of stresses in annealing glass is derived. Although the derivation is based on Maxwell's equation for viscous flow, consideration is also given to the changing viscosity as a glass anneals at a constant temperature. This equation is applied to data obtained on the relaxation of stresses in annealing glass at various temperatures.